

# **MISSOURI STATE EMERGENCY MANAGEMENT AGENCY**



## **MISSOURI STATE HAZARD MITIGATION PLAN**

May 2004

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# INTRODUCTION

Hazard mitigation--defined by the Federal Emergency Management Agency as any action taken to eliminate or reduce the long-term risk to human life and property from natural and technological hazards--is crucial to the citizens of Missouri. Because they are subject to many kinds of natural disasters, in particular tornadoes, floods, drought, earthquakes, severe winter weather and wildfires, the citizens of Missouri realize the importance of preparation.

Recognizing that the effects of most disasters can be lessened by proper planning and preventative measures, this State Hazard Mitigation Plan has been written to establish the means the State of Missouri will use to identify cost effective mitigation measures, including reduction or avoidance, that can be taken to reduce or eliminate the long-term risk to human life and property from natural hazards. It is the result of a systematic evaluation of the nature and extent of vulnerability to the effects of natural hazards present in the State of Missouri and includes those actions needed to minimize future vulnerability to those hazards.

This plan has taken into account many years of mitigation experience, and a variety of mitigation projects, from Missouri and other states. It has taken advantage of the collective mitigation knowledge of many State, Federal, and Local officials, as well as representatives from both the public and private sectors, and is designed as one component to help safeguard the citizens of the State of Missouri. As such, it should significantly contribute to the mitigation of future Missouri disasters. Without the help and coordinated assistance of many federal, state, and local officials, this program would not be the success it is in the State of Missouri.

As a result of the disastrous flooding of 1993, the Governor of Missouri, in Executive Order 93-40, expressed the need for a state policy that focuses on minimizing the effects of future flood devastation. It is essential that state policy be directed to minimize the risk of future devastation and that proper management of areas in the floodplain, including development, rebuilding, and other post flood projects, requires proper attention to sound long-range policy. Subsequent flooding disasters and the continued threat of these events to the State creates significant interest in nonstructural flood hazard mitigation measures at the national, state and local level. However, mitigation measures must address not only flooding but other hazards as well. Therefore, this state hazard mitigation plan considers all natural hazards that threaten the citizens of the State of Missouri.

This plan is designed to provide a blueprint for hazard mitigation activities in the general sense of the program and is structured to serve as a basis for specific hazard mitigation efforts for any disaster. It is recognized, however, that updates may be required to address specific issues arising from a given disaster.

This plan identifies hazards and considers ways to reduce vulnerability to natural hazards in Missouri. It encompasses a range of life- and property-saving hazard mitigation initiatives in the categories of mitigation coordination, acquisition/relocation/retrofitting, floodplain management, public safety, emergency preparedness, earthquake, tornado, drought, etc. Both short-term and long-term hazard mitigation measures are identified in order to help all state and local agencies allocate resources in a responsible manner in order to provide for the public safety, public health, and general welfare of all the people in Missouri.

## 1.0 PREREQUISITES

Hazard mitigation has become an increasingly important component of disaster recovery since 1988 when the Disaster Relief Act of 1974, P.L. 93-288, was amended by P.L. 100-707, the Robert T. Stafford Disaster Relief and Emergency Assistance Act. Even greater emphasis was placed on hazard mitigation and pre-disaster mitigation (Section 203) with the enactment of the Disaster Mitigation Act of 2000. This expanded State Hazard Mitigation Plan is a direct result of that amendment to the Stafford Act.

Section 406 of the Stafford Act establishes the program for the repair, restoration, and replacement of facilities damaged as a result of a presidentially declared disaster. These funds can also be used to fund hazard mitigation measures the State or local government determines to be necessary to meet a need for governmental services and functions in the area affected by the major disaster. Section 406 mitigation funds can only be used in the declared disaster areas (usually counties) and only in conjunction with identified, eligible disaster projects.

Section 404 allows the President to contribute up to 75 percent of the cost of hazard mitigation measures which the President has determined are cost-effective and which substantially reduce the risk of future damage, hardship, loss, or suffering in any area affected by a major disaster. Such mitigation measures shall be identified following the evaluation of natural hazards under Section 322 of the Disaster Mitigation Act. Total contributions for hazard mitigation under Section 404 shall not exceed fifteen (15) percent of the estimated federal assistance (excluding any associated administrative costs) provided as a result of a presidential disaster declaration. (Note: The FY 2003 appropriations bill instituted a not to exceed percentage of seven and one half (7.5) percent. Section 404 mitigation funds can be used anywhere in the state based on the state's mitigation priorities and requirements.

Section 322 establishes a requirement for a State Hazard Mitigation Plan. To receive federal mitigation funds, States must develop and submit for approval to the Federal Emergency Management Agency (FEMA) a "standard" Hazard Mitigation Plan that includes details of the State's natural hazards, risks, vulnerabilities, mitigation goals, objectives and priorities. Section 322 of the Act also allows the President to increase the mitigation contributions to twenty (20) percent of the federal assistance if the approved State Hazard Mitigation Plan contains additional "enhanced" mitigation program management information. This document is the State of Missouri's standard and enhanced State Hazard Mitigation Plan.

### 1.1 Plan Adoption

**Requirement 44 CFR §201.4(c)(6): The plan must be formally adopted by the State prior to submittal to [FEMA] for final review and approval.**

The Missouri Hazard Mitigation Plan is the result of the systematic evaluation of the nature and extent of vulnerability to the effects of natural hazards present in the State of Missouri and includes the actions needed to minimize future vulnerability to those hazards. It sets forth the policies, procedures, and philosophies that will be used to establish and implement hazard mitigation activities within the State of Missouri. Effective and consistent implementation of this plan is crucial to the hazard mitigation program and the State's efforts to reduce or eliminate the threat of future disasters. This Hazard Mitigation Plan, formally adopted May 12, 2004,

incorporates all changes associated with the implementation of the Federal/State hazard mitigation program, including the applicable sections of the Disaster Mitigation Act of 2000. Overall administration of the hazard mitigation program shall be the responsibility of the Missouri State Emergency Management Agency, Floodplain Management & Mitigation Assistance Branch. This branch will review and update the plan annually, or if hazard mitigation regulations or guidelines change, the review will be as needed. Additionally, the plan or update will be submitted to FEMA Region VII following a Presidential disaster declaration if the State's priorities have been changed.

The final State of Missouri Hazard Mitigation Plan will be submitted to the State Emergency Management Agency Director, as the authorized representative of the Governor, for final approval. When the Director approves the plan, a letter with his/her signature will declare the document as officially adopted by the State. The document will then be forwarded to FEMA Region VII for review.

## **1.2 Compliance With Federal Laws And Regulations**

**Requirement 44 CFR §201.4(c)(7): The plan must include assurances that the State will comply with all applicable Federal statutes and regulations in effect with respect to the periods for which it receives grant funding, in compliance with §13.11(c). The State will amend its plan whenever necessary to reflect changes in State or Federal laws and statutes as required in §13.11(d).**

This mitigation plan is included in the Missouri State Emergency Operations Plan (SEOP) as Appendix 5 to Annex Q (Disaster Recovery). This plan complies with State and federal regulations, as cited in the Authorities and References and other portions of the plan.

## **2.0 PLANNING PROCESS**

### **2.1 Documentation of the Planning Process**

**Requirement 44 CFR §201.4(c)(1): The plan must include a description of the planning process used to develop the plan, including how it was prepared, who was involved in the process, and how other agencies participated.**

The key to the development of a sound mitigation plan is the establishment of essential elements of the planning process. The following are some of the elements used to develop this plan:

- Identify the types of natural hazards that affect the state and develop a brief history of each.
- Determine the present and future risk and vulnerability of Missouri citizens to these hazards.
- Determine our present capability to deal with hazards and disasters at the local, state and federal levels.

- Establish and prioritize the major hazard mitigation issues that should be addressed in the Missouri Hazard Mitigation Plan.
- Determine goals, objective, measures (actions) and strategies for addressing these issues to reduce the state's vulnerability to present and future hazards.

### ***EVOLUTION OF THE PLAN'S DEVELOPMENT:***

The Missouri State Emergency Management Agency has been developing the State Hazard Mitigation Plan over a period of several years. Initially, mitigation goals and objectives were developed separately under the purview of a number of entities. Over the years, the works of these various entities have been incorporated into the State 409 plan and subsequently into the State Hazard Mitigation Plan. Missouri is somewhat unique in that the HMGP, FMA, PDM, floodplain management, Earthquake Program and mitigation planning are all the direct responsibility of SEMA.

The current State Hazard Mitigation Plan is the result of the combined efforts of the multi-year contributions of numerous entities, including the State Emergency Management Agency, State Hazard Mitigation Project Coordinating Group, Federal Emergency Management Agency, Natural Resources Conservation Service (NRCS), U.S. Army Corps of Engineers, the National Weather Service, nineteen (19) Missouri Regional Planning Commissions and/or Councils of Government (RPCs), local governments, electric cooperatives throughout the State, special entities established by the State of Missouri, professional organizations, volunteer agencies, special consortiums, and concerned citizens. Various state agencies and departments provided this plan's input regarding their own ongoing mitigation initiatives and other possible sources of funding for mitigation projects. Missouri's planning and program success should be evident in the pages of description that follow. This Continuous Improvement Process is ongoing yet today.

### ***Original State 409/State Hazard Mitigation Plan***

According to SEMA's May 1994 State Hazard Mitigation Plan, there were a large number of agencies involved in the development of the original plan. The participants at various times and meetings over the years have included and will continue to include:

#### **STATE AGENCIES**

Missouri Department of Public Safety  
 State Emergency Management Agency  
 Missouri Office of Administration  
 Missouri Department of Natural Resources  
     Division of Geology and Land Survey  
     Water Resources Program  
     Division of Environmental Quality  
 Missouri Department of Health  
 Missouri Department of Agriculture  
 Missouri Attorney General's Office  
 Missouri Department of Economic Development  
 Missouri Department of Highway and Transportation



Missouri Department of Conservation  
Missouri Department of Corrections

### **QUASI-PUBLIC AGENCIES**

American Red Cross  
Salvation Army  
Missouri Association of Councils of Governments

### **FEDERAL AGENCIES**

Federal Emergency Management Agency  
    Region VII  
U.S. Army Corps of Engineers  
U.S. Department of Agriculture  
    Rural Development Agency  
U.S. Forest Service  
Soil Conservation Service  
U.S. Department of Housing and Urban Development  
U.S. Department of Commerce  
    Economic Development Administration  
National Oceanic and Atmospheric Administration  
    National Weather Service  
U.S. Department of the Interior  
    U.S. Geological Survey  
    U.S. Fish and Wildlife Service  
U.S. Environmental Protection Agency  
U.S. Small Business Administration  
U.S. Department of Transportation  
    Federal Highway Administration

In addition, there have been a number of multi-stakeholder groups and bodies that have contributed to the development of this plan over the years.

### ***Task Force on Flood Plain Management***

Due to the extensive devastation resulting from the 1993 flooding, there was renewed interest in nonstructural flood hazard mitigation measures at the national, state and local level. Governor Mel Carnahan appointed a Task Force on Floodplain Management, by authority of Executive Order 93-40. The task force included two members each from the House of Senate; directors (or designees) of the departments of Agriculture, Natural Resources, Conservation, Highways and Transportation, Economic Development, Public Safety, the Office of Administration; representatives from Missouri Housing and Development commission, Missouri Municipal League, Missouri Association of Counties; the State Treasurer; as well as three others designated by the Governor. Federal agencies were encouraged to actively participate in the Governor=s Task Force; in particular, the USACE and USDA-SCS was notified of meetings and deliberations.

This task force evaluated Missouri's flood threat, identified mitigation measures, helped implement them and provided input into the State 409 Plan. As stated in E.O. 93-40, Governor Carnahan determined that it was essential that state policy be directed to minimize the risk of future devastation and that proper management of areas in the floodplain, including development, rebuilding, and other post flood projects, required proper attention to sound long-range policy. The Governor's Task force reviewed and made recommendations on the building, rebuilding or relocation of levees; State highway and road projects in flood plains; and expenditures of public funds for projects in flood plains which require State action or approval. The Task Force also made recommendations on the State's role regarding long-term policies in floodplain areas.

### ***Long-Term Recovery and Unmet Needs Groups***

Long-Term Recovery groups and Unmet Needs groups also have contributed recommendations regarding flood buyout projects, and repetitive loss properties especially. In addition, following 12 Presidentially declared disasters since 1993, (every Missouri county, numerous local officials, volunteer agencies and citizens from counties and communities all over the state have met with SEMA officials concerning mitigation projects such as flood buyouts, repetitive loss structures, ice storm damage prevention projects, tornado warning systems, weather warning transmitters and radios, and tornado safe rooms. Many other local officials have met with SEMA officials concerning earthquake safety, preparedness and mitigation. These recommendations have all been acted on by SEMA and have served to assist SEMA in developing the goals, objectives and actions contained in this mitigation plan.

### ***Association of State Floodplain Managers (ASFPM)***

The ASFPM has approximately 5,000 members located in 16 chapters across the country, with chapters pending in most of the remaining states. The ASFPM mission is to mitigate the losses, costs, and human suffering caused by flooding, and to protect the natural and beneficial functions of floodplains. The association promotes mitigation, serving as a mitigation advocate, providing advice and education to legislators and government officials at all levels, and certifying floodplain managers. Missouri is a chapter state and follows the precepts, training and advice provided by the ASFPM in overseeing the management of the National Flood Insurance Program (NFIP) in the state. Floodplain management, floodplain mapping, the Community Rating System are strongly supported by the ASFPM. The association publishes mitigation success stories, history and information about good floodplain management, No Adverse Impact (NAI) development, and changes to legislation to help its members perform their duties. The ideas and principles promoted by the ASFPM have played an important influence in the development of this plan.

### ***Central United States Earthquake Consortium (CUSEC)***

Mitigation planning in Missouri, however, predates the 1993 floods. Since 1983, the states of Arkansas, Illinois, Indiana, Kentucky, Mississippi, Missouri, and Tennessee have been members of the Central United States Earthquake Consortium (CUSEC). CUSEC was formed to improve public earthquake awareness and education; coordinate multistate planning for earthquake mitigation, preparedness, response, and recovery; and encourages research in earthquake hazard

reduction. The Earthquake Program Managers of the member states and the State Emergency Management Directors meet at least twice annually with CUSEC management and FEMA's Regional Earthquake Program Managers to formulate earthquake safety and mitigation programs and projects. Most of CUSEC's funding is provided from FEMA's NEHERP budget currently managed by FEMA's Mitigation Division. Following the prediction of Browning that an earthquake of magnitude 7 would strike the area of the New Madrid Fault Zone on December 3, 1990, the USGS, advised by private, academic, and government experts, issued a plan for intensified study of the New Madrid seismic zone. At the same time, the National Earthquake Hazards Reduction Program, with FEMA as the lead organization, further expanded efforts to study and mitigate the adverse effects of earthquakes in the central United States.

### ***Structural Assessment and Visual Evaluation (SAVE) Coalition***

On December 2, 1991, Missouri's Structural Assessment and Visual Evaluation (SAVE) Coalition met for the first time. The Coalition's architects, engineers and professional building officials have provided multiple suggestions over the years for mitigating the adverse effects of earthquake and assisted SEMA in educating both the general public and their professional communities. The SAVE Coalition's members are largely drawn from the Coalition's participating Professional Organizations, including the American Council of Engineering Companies/Missouri (ACEC/MO), the American Institute of Architects/ Missouri (AIA/MO), the American Society of Civil Engineers (ASCE), the Missouri Society of Professional Engineers (MSPE) and the Structural Engineers Association of Kansas and Missouri (SEAKM). The SAVE Coalition's members are trained in the inspection techniques developed by the Applied Technology Council for the ATC-20 and ATC-21 courses. During this day of training, many non-structural mitigation measures and techniques also are taught to the volunteer inspectors. Many of the SAVE Coalition's members also belong to the Earthquake Engineering Research Institute (EERI) and provide recommendations aimed at reducing earthquake risk through better earthquake engineering, by improving understanding of the adverse impact of earthquakes, and by advocating comprehensive measures for reducing the harmful effects of earthquakes. In addition, a number of Missouri Department of Transportation (MODOT) officials have become SAVE Coalition members and Missouri now builds roads and bridges to earthquake design specifications in threatened counties. Moreover, MODOT also has work underway to mitigate some existing roads and bridges, and has partnered with the Hazard Mitigation Institute at the University of Missouri – Rolla engineering campus to study ways to better determine potential earthquake damages to Missouri's roads and bridges and to develop appropriate mitigation measures. Many of the ideas and suggestions offered by SAVE members have been considered in the development of this plan. CUSEC views Missouri's program as a model for other states, and Indiana has requested Missouri's assistance in developing a SAVE Coalition in that state. The SAVE Coalition meets on a quarterly basis.

### ***Missouri Seismic Safety Commission***

In 1996, Missouri formed its first Missouri Seismic Safety Commission comprised of 15 subject matter experts in various fields of seismology and geology, engineering, emergency management, fire protection, planning, public utilities, insurance, business, the American Red Cross and local government. In addition, a member of the Senate and House of Representatives also serve on the Commission. One of the Commission's first acts was to prepare a Strategic

Plan for Earthquake Safety in Missouri. This plan includes an entire section of recommendations for earthquake mitigation that has helped guide SEMA's Earthquake Program. Missouri's legislature also passed statutes requiring school districts in the 47 counties most threatened by earthquake disaster to develop emergency procedures for earthquake safety education and drills to mitigate damages. In addition, the Missouri's legislature passed statutes requiring public buildings in excess of 10,000 square feet to be built to seismic code in those 47 counties. CUSEC views Missouri's program as a model for other states, and has formed a working group to promote the establishment of Commissions in other member states. The Chair for the Missouri Seismic Safety Commission serves on the CUSEC working group. The Commission meets 2-3 times annually to educate the public and offer recommendations to SEMA's Director.

### ***Project Impact Disaster Resistant Communities***

In 1998, the Missouri communities of Cape Girardeau and St. Joseph were selected to become FEMA Project Impact Disaster Resistant Communities. From 1998 – 2000, the Missouri communities of Branson, Bolivar, Hannibal, Maryville, Neosho, and Piedmont also were selected to become Project Impact communities. SEMA worked with these communities to help them develop mitigation projects and local mitigation plans in the case of all but one of these communities. Neosho was recognized by FEMA for "Best Practices" for its mitigation program, funded in part by local taxes, to remove properties from the floodplain, develop flood detention basins and develop parks in the open space buyout areas. St. Joseph developed a model ordinance for requiring tornado safe rooms in new mobile home parks. While helping develop these local plans, SEMA's mitigation staff attended multiple mitigation planning sessions with local officials, professionals, volunteer agencies, schools, and interested citizens. SEMA's mitigation staff taught about mitigation and also learned directly how Missouri's citizens view the needs and priorities for flood buyouts, tornado safe rooms, NOAA weather warning radios, floodplain management, flood insurance, creek cleanup, building codes, earthquake insurance, dam safety, public education, preparedness and response. These ideas also were used in the development of this plan.

### ***Local, State and National Volunteer Groups***

SEMA's Statewide Volunteer Coordinator has worked for years to bring together local, state and national voluntary organizations through the Disaster Recovery Partnership, Community Organizations Active in Disaster (COAD) and the Missouri Voluntary Organizations Active in Disaster (MOVOAD). For example, the Missouri Voluntary Organizations Active in Disaster (MOVOAD) is dedicated to protecting public health and the environment by assisting communities with chemical incident prevention, preparedness, response and recovery. The State Red Cross even formed a mitigation committee that SEMA's staff participated in as members, helping to develop mitigation surveys, plans and training. MOVOAD's members participate in disaster mitigation, preparedness, response and recovery planning, exercises and training. The lessons learned through such exercises and training are used to improve plans such as the State local Hazard Mitigation Plans. MOVOAD works to foster more effective service through mitigation and response for the benefit of people affected (imperiled and impacted) by disaster through:

1. Cooperation: To create a climate of cooperation at all levels (including grass roots) to provide information.
2. Coordination: To coordinate policy among member organizations and to serve as a liaison, advocate and national voice.
3. Communication: To disseminate information through the newsletter, the director, research and demonstration, case study and critique.
4. Education: To increase mutual awareness and understanding of each organization.
5. Convention Mechanisms: To arrange for such meetings and conferences as necessary to accomplish the purpose of MOVOAD.
6. Legislation: To encourage effective disaster relief legislation and policy.

### ***Missouri Emergency Response Commission (MERC)***

Likewise, the Missouri Emergency Response Commission (MERC) is dedicated to protecting public health and the environment by assisting communities with chemical incident prevention, preparedness, response and recovery; and by receiving, processing and reporting on chemical information received under the community right-to-know laws. Through lessons learned in exercises, training and actual events, the MERC and its participating Local Emergency Response Committees (LEPCs) improve local and state ability to manage and mitigate chemical incidents. They also are instrumental in developing Local Emergency Operations Plans (LEOP), for responding to, recovering from and mitigating such incidents.

### ***Regional Planning Commissions/Council (RPC)***

As part of the process to update the State Hazard Mitigation Plan, SEMA has participated in numerous in open public meetings conducted by the 19 Regional Planning Commissions and/or Councils of Government (RPCs), counties and local governments as part of their mitigation plan preparation and review process for developing local Hazard Mitigation Plans for 55 counties and 571 jurisdictions. Initially, nineteen of these meetings were conducted throughout the State to ensure that every interested citizen had an opportunity to participate in the process. Attendance at these meetings varied from eight to thirty. These 19 meetings were followed by several other plan development meetings attended by representatives from SEMA to discuss State mitigation planning and to listen to the thoughts and ideas of all present regarding potential mitigation opportunities. Over the last two years, this has enabled the State to discuss and take into consideration the mitigation needs of multiple stakeholders in local communities throughout the State.

### ***State Hazard Mitigation Project Coordinating Group (HMPCG)***

Following disasters, SEMA also works to implement the components of this plan by being a part of the State Hazard Mitigation Project Coordinating Group, which at various times has included the Missouri Department of Agriculture, the Missouri Department of Economic Development, the Missouri Department of Health, the Missouri Department of Natural Resources, and the Missouri Department of Transportation. Other departments have been incorporated in the Group's activities as deemed necessary.

The primary responsibilities of the State Hazard Mitigation Project Coordinating Group are as follows:

1. Review proposed hazard mitigation projects to ensure they are in compliance with the State's mitigation priorities.
2. Explore all potential sources of mitigation funding to ensure the State obtains the most hazard mitigation opportunities possible.
3. Ensure proposed mitigation projects do not conflict with other State/Local initiatives.
4. Participate in the development, review, and update of the State Hazard Mitigation Plan, as needed.

While the agencies mentioned above represent the core of the State Hazard Mitigation Project Coordinating Group, they are not the sole contributors to the hazard mitigation process. The State of Missouri Hazard Mitigation program involves all levels of government, businesses, non-profit organizations, and private citizens.

## ***SUMMARY OF CURRENT PLANNING PARTICIPATION***

By using all the multiple mechanisms described in this section of this State Hazard Mitigation Plan, SEMA was able to help educate multiple stakeholders about Missouri's hazards, from the perspective of the State Hazard Analysis, help them develop their local plans, and obtain local mitigation ideas and suggestions into the State plan. In this manner, SEMA received participation from all levels of government, industry, and private citizens. Participating agencies, government officials, business representatives, and private citizens have had opportunities to present their views and concerns related to both the local and State mitigation programs. It also has demonstrated to the public that the local and state planning program is a joint effort and requires the support of everyone to succeed.

## **2.2 Coordination Among Agencies**

**Requirement 44 CFR §201.4(b): The mitigation planning process should include coordination with other State agencies, appropriate Federal agencies, and interested groups.**

As the Agency designated by the Governor to coordinate statewide emergency preparedness, response, recovery and hazard mitigation activities, the State Emergency Management Agency (SEMA) works with other state, federal and local agencies to develop and implement the strategies outlined in this document, obtain interagency feedback on the mitigation steps taken and use that information in updating this plan. The methodology employed by SEMA to obtain this feedback is through the active coordination of interagency mitigation actions being undertaken.

The Mitigation Section of the Floodplain Management & Mitigation Assistance Branch within SEMA has the following general responsibilities:

- Administering the mitigation program;
- Coordinating program activities with other State, federal, and local governments;
- Serve as representative on the State Hazard Mitigation Project Coordinating Group;
- Identifying cost-effective mitigation projects;
- Inspecting completed mitigation projects;
- Preparing mitigation project close-out reports;
- Preparing and conducting presentations on various mitigation activities and programs;
- Developing, reviewing, and updating this mitigation plan.

SEMA also works to implement the components of this plan by being a part of the State Hazard Mitigation Project Coordinating Group, the state agencies that participate in the Missouri Seismic Safety Commission, those state agencies that participate in developing mitigation measures associated with Public Assistance projects, and state educational institutions that have participated in the mitigation program.

Mitigation and other staff members from FEMA Region VII and FEMA National have reviewed the State's first draft mitigation plan against FEMA's plan criteria. Their review and comments provided valuable information related to the content needed to meet the requirements of the Disaster Mitigation Act of 2000.

This State of Missouri Hazard Mitigation Plan is a stand-alone plan; however, because of the importance that the State places on mitigation initiatives and activities, it is also included as an appendix to the Missouri State Emergency Operations Plan (SEOP). This enables all State agencies to reference the document when seeking information and guidance on State mitigation goals and objectives.

### **2.2.1 Process for Plan Revisions**

The Floodplain Management & Mitigation Assistance Branch will be the primary branch reviewing and revising the following sections of this plan at least every three years:

1. Introduction and Appendix (Authorities and References)
2. Comprehensive Mitigation Plan
3. Enhanced Plan (Staffing)

The Planning & Disaster Recovery Branch will take the lead as the primary branch reviewing and revising the Risk Assessment.

The Floodplain Management & Mitigation Assistance Branch and the Planning & Disaster Recovery Branch will jointly review and revise the following sections of the plan:

1. Plan Maintenance Procedures
2. Local Mitigation Planning Coordination

Representatives from the departments comprising the State Hazard Mitigation Project Coordinating Group will review the plan and provide input and suggested changes based on the mitigation initiatives being undertaken by their respective organizations. A joint meeting of all departments/personnel involved in the plan review/update process will be conducted to ensure that the plan continues to meet the needs of the State.

The State of Missouri Hazard Mitigation Plan was developed by the State Emergency Management Agency with the use of information contributed by other State and Federal agencies. As hazard mitigation planning continuously involves multiple government agencies, private voluntary organizations and commerce & industry, it is assumed the role of other entities in revising this plan will increase over time. This plan will be adjusted accordingly during the review process.

## **2.3 Integration With Other Planning Efforts**

**Requirement 44 CFR §201.4(b): The plan must be integrated to the extent possible with other ongoing State planning efforts as well as other FEMA mitigation programs and initiatives.**

The State of Missouri is fully committed to an effective and comprehensive mitigation program. Missouri is somewhat unique in that the HMGP, FMA, PDM, floodplain management, Earthquake Program and mitigation planning are all the direct responsibility of SEMA. In order for these programs to achieve their full potential, multiple state activities should compliment appropriate mitigation goals and strategies. The best way to accomplish that task is to ensure that mitigation goals and initiatives are integrated to the maximum extent into all possible planning activities for Federal, State and local governments. Over the years, the works of these various entities have been incorporated into the State Hazard Mitigation Plan and the planning of other state agencies. For example, mitigation is a consideration to the extent possible by Missouri Statutes, in the earthquake plans of the Departments of Transportation, Insurance, Corrections, Natural Resources, the Office of Administration, the Department of Education, and the Public Service Commission, Missouri Seismic Safety Commission, Missouri Emergency Response Commission, etc. The Department of Transportation considers mitigation, especially floodplain management and open space issues, in their transportation plans. The Department of Conservation has partnered with SEMA in developing stream bank stabilization planning to help mitigate flooding problems in communities such as Piedmont, Missouri.

The State Hazard Mitigation Plan is only a part of the State's mitigation program. The Local Mitigation Plans comprise another part of the program. As such, the development process for the State plan takes into consideration the mitigation goals and objectives identified in the local plans. In addition, SEMA routinely works with numerous state and federal agencies on various issues. SEMA intends to share the State Hazard Mitigation Plan with Federal and State agencies and local governments to cross-fertilize mitigation information with as many of them as possible.



### **2.3.1 Integration of Local Plans**

SEMA is the primary State coordinating agency for all local emergency operations plans and hazard mitigation plans. The Floodplain Management & Mitigation Assistance Branch has the primary responsibility to work with local governments in developing, reviewing, and updating local hazard mitigation plans. The Planning & Disaster Recovery Branch, through its assigned area coordinators (planners) has the primary responsibility to work with local governments in developing, reviewing, and updating local emergency operations plans.

As part of the State mitigation planning initiative, local mitigation plans are being developed for each county and/or region. These multi-jurisdictional plans will address the mitigation issues/initiatives for the unincorporated parts of the county and for the incorporated jurisdictions within that county. This will help ensure that as many jurisdictions as possible remain involved in the mitigation planning process. The Local Hazard Mitigation Plan will normally be a separate stand-alone plan by county and/or region. Some jurisdictions may develop their hazard mitigation plan as an Annex to a jurisdiction's Local Emergency Operations Plan. Any jurisdiction within a county may prepare a mitigation plan specific to that jurisdiction, separate from the county mitigation plan.

Every county (114) in the state and the City of St. Louis has a Local Emergency Operations Plan (LEOP). These plans are scheduled for review and/or update by a SEMA planner/area coordinator about once every five years. In addition, approximately 30 incorporated cities maintain separate Local Emergency Operations Plans. These plans are also included in the five year SEMA review/update process.

The local governments and RPCs are using the information contained in the State Hazard Mitigation Plan to develop the multi-jurisdictional hazard mitigation plans. SEMA's contractual planning development agreements with the RPCs also ensure that SEMA retains the right to use the information developed in the local mitigation plans. Thus, as the local hazard mitigation plans are developed, the information provided through those planning efforts will be available to SEMA to incorporate into the State Hazard Mitigation Plan, thereby contributing to the continuous improvement of all the plans when they are reviewed and updated every three years for the state and every five years for the local plans.

### **2.3.2 Integrating Planning Information with Other Mitigation Partners**

The State Hazard Mitigation Plan identifies Missouri's hazards, risks, vulnerabilities, goals, objectives, priorities and strategies for mitigation. The plan is the basic document that has been used by SEMA to focus many efforts to improve the lives of Missouri citizens. Over the years, SEMA has worked continuously to identify partners (federal, state, local, and business) interested in participating in the State's mitigation efforts. Integration of other federal, State, and local agencies, business and industry, and private non-profit organizations into the State mitigation program has been an ongoing process that also has helped educate SEMA's partners concerning the importance of mitigation. This educational process also has resulted in SEMA's partners using mitigation in their programs and plans over time. These discussions and/or meetings have involved reviews of current programs and policies that promote or could potentially promote mitigation initiatives throughout the State and reviews of existing and proposed plans to identify mitigation opportunities. Many of the mitigation successes since the

1993 floods have been as a direct result of these meetings. The lessons learned through these programs and activities have contributed to the development of this plan and have been integrated into their own plans and programs.

In addition to working with FEMA in all aspects of hazard mitigation projects and plans, SEMA has worked with multiple other mitigation partners to integrate mitigation into projects and plans. The Natural Resources Conservation Service (NRCS) and U.S. Army Corps of Engineers provided input and advice on several mitigation initiatives in the State regarding retention/detention basins. The successful combination of SEMA buyout and NRCS retention basins in the City of Neosho, a Project Impact Community, are an excellent example of their support. An NRCS feasibility study led the City of Piedmont to develop several flood buyout programs to mitigate flooding over time and Project Impact Disaster Resistant Community Status. Piedmont also has worked with the Missouri Department of Conservation to reduce flooding through creek clean up and stream bank stabilization activities and plans. In addition, Piedmont and the City of Maryville have worked with the Economic Development Agency, using SEMA's hazard mitigation planning process to develop community-wide business plans for disaster survivability. The City of Hannibal (another Project Impact community) followed Piedmont's creek clean up lead and has conducted similar activities. Around 570 MO Missouri communities participate in the National Flood Insurance Program (NFIP) and three participate in the Community Rating System (CRS). The SEMA Floodplain Management Section of the Floodplain Management & Mitigation Assistance Branch conducts approximately twenty (20) workshops each year promoting the NFIP program to non-participating communities. Additional workshops are conducted to promote the CRS program. These workshops have been instrumental in increasing the number of communities participating in both of these programs.

The Missouri Department of Economic Development's (DED) Community Development Block Grant Program (CDBG) has complemented the SEMA buyout program in removing homes and businesses from the flood hazard areas throughout the State. The SEMA program has concentrated on primary family residences, while the CDBG program has included businesses and some residences. Together these programs have made a significant impact on the overall vulnerability of individuals to flooding. The U.S. Army Corps of Engineers has worked with SEMA on several levee projects and requests for channelization projects. The Missouri Department of Conservation has worked with SEMA on endangered species and fish and wildlife management issues associated with flood buyouts and water management and conservation questions. The Missouri Department of Agriculture works with SEMA on agriculture and drought issues and planning, including ways to mitigate damages.

The Missouri Department of Insurance supports SEMA in promoting flood and earthquake insurance, preparedness, response and mitigation issues and plans. The Missouri Department of Natural Resources (DNR) has worked with SEMA on flood buyouts, hazardous material planning, earthquake mitigation and dam safety plans and issues. The Missouri Department of Transportation, the U.S. Department of Transportation and the Federal Highway Administration have worked with SEMA on flood buyouts, open space restriction issues, and earthquake planning and bridge retrofits. In addition to the state and federal transportation agencies, the U.S. Geological Survey, the Central U.S. Earthquake Consortium (CUSEC), the Missouri DNR, the Missouri Department of Insurance, the Missouri Seismic Safety Commission, the Missouri Structural Assessment and Visual Evaluation (SAVE) Coalition (members include the American

Council of Engineering Companies/Missouri [ACEC/MO], the American Institute of Architects/Missouri [AIA/MO], the American Society of Civil Engineers [ASCE], the Missouri Society of Professional Engineers [MSPE] and the Structural Engineers Association of Kansas & Missouri [SEAKM]), the University of Missouri Rolla School of Civil Engineering and Natural Hazards Mitigation Institute (NHMI), Saint Louis University Earthquake Center, Washington University, Southern Illinois University-Edwardsville, the University of Memphis Center for Earthquake Research and Information (CERI) and the Earthquake Engineering Research Institute (EERI) New Madrid Chapter work with SEMA on earthquake mitigation, including retrofits, public education, soil mapping and seismic studies.

The National Weather Service (NWS), the Electric Cooperatives, and private businesses combined their resources to support the expansion of the State's weather radio transmitters. In four years this project has expanded weather radio coverage to include almost the entire State. SEMA supports the NWS StormReady program in Missouri, with 7 counties, 20 communities and 1 industrial site, and the many mitigation measures included in that program and its plans. SEMA has supported efforts to reduce damages from storms, such as the project undertaken by the City of Independence to bury electric service lines to homes that were damaged by the severe Ice Storm of 2002. SEMA's work with the City of Bolivar (a Project Impact community) helped them to procure and issue NOAA weather warning radios to local schools, nursing homes, day care centers and college dormitories. Several Missouri businesses and business associations have worked with SEMA and local communities on disaster mitigation and business continuity planning. SEMA's Statewide Volunteer Coordinator has worked for years to educate local, state and national voluntary organizations through the Disaster Recovery Partnership, Community Organizations Active in Disaster (COAD) and the Missouri Voluntary Organizations Active in Disaster (MOVOAD) about the importance of mitigation. SEMA's staff served on the State Red Cross mitigation committee.

SEMA has identified many instances where the information contained in this State Hazard Mitigation Plan could be, and in many cases previous versions of this plan over time, have been integrated into the planning of other State and Federal departments, local governments, universities, businesses and private associations. SEMA asks that all interested entities freely use the information provided in this plan in the development of and management of their plans and programs. For example, the information contained in this plan should be of interest and useful in general for all local governments, universities, businesses and private associations, and as follows for various State and Federal departments and agencies, to include at a minimum:

## **Flood Issues**

The Natural Resources Conservation Service (NRCS)  
MO Department of Conservation

U.S. Army Corps of Engineers (ACOE)

National Flood Insurance Program (NFIP)  
& MO Department of Insurance  
& Community Rating System

MO Department of Economic Development (DED) &  
Community Development Block Grant Program  
(CDBG)

MO Department of Natural Resources (DNR) & SHPO

MO Department of Transportation &  
DOT & Federal Highway Administration

## **Environmental Issues**

MO Department of Natural Resources  
MO Department of Conservation

## **Severe Weather Issues**

National Weather Service (NWS/NOAA)  
& Community Utility Cooperatives & CDBG

## **Earthquake & Transportation Issues**

USGS & MO DNR & CUSEC &  
MO Seismic Safety Commission & SAVE Coalition &  
Multiple Universities & Professional Associations &  
MO Department of Transportation &  
DOT & Federal Highway Administration

## **Drought & Fire**

U.S. Department of Agriculture &  
MO Department of Agriculture  
U.S. Fire Administration  
MO Fire Administration

- Retention/Detention basins
- Stream bank stabilization
- Creek cleanup activities
- Levees
- Channelization
- 570 MO Communities participate
- 20 MO Workshops yearly
- 3 MO Communities &
- Several workshops yearly
- Flood buyouts
- Community development
- Stormwater control
- Open Space deed restrictions
- Flood buyouts
- Dam Safety
- Flood buyouts
- Open Space deed restrictions

- HAZMAT management
- Water management & conservation
- Endangered species management
- Fish & wildlife management

- StormReady Program
- Weather radio transmitters
- Bury utility lines
- Tornado Safe Rooms

- Seismic studies
- Soil mapping
- Public education
- Retrofits
- Building codes

- Public education
- Conservation
- Risk Management

**Note: This list is not inclusive and all would be of interest for FEMA's mitigation planning. Free compact disk copies of this plan may be requested from SEMA for planning, program management and public education purposes by calling the Floodplain Management & Mitigation Assistance Branch at (573) 526-9116.**

## 3.0 RISK ASSESSMENT

### FORWARD

This document presents the results of a risk and vulnerability assessment conducted for the State of Missouri. This risk assessment is part of the State Hazard Mitigation Plan and is intended to support the State's long-term hazard mitigation planning efforts. The risk assessment effort was conducted during September 2003 through December 2003. It was prepared to satisfy the requirements of the Disaster Mitigation Act (DMA) of 2000 and to meet the State of Missouri goal for developing a model State mitigation plan that will serve as a template for local mitigation plans across the state. The risk assessment was prepared in accordance with guidance outlined in the FEMA's *A Guide to Using HAZUS for Mitigation*, and *State and Local Mitigation Planning How-To-Guide: Understanding Your Risks – Identifying Hazards and Estimating Losses*.

The framework of the risk assessment was developed to provide a basis for activities proposed during the State's mitigation planning effort, and should be used by state and local officials to plan and prioritize resource allocations. Local officials can use information in this document to develop their own localized hazard analysis. The risk assessment results should be used to identify and prioritize appropriate mitigation actions to minimize potential losses from hazards identified in this study.

### 3.1 Identifying Hazards

**44CFR 201.4(c)(2)(i) – The risk assessment shall include an overview of the type of all natural hazards that can affect the state.**

Based on input such as historical data, public perception, and technical requirements, the following 17 hazards (listed alphabetically) were considered for analysis:

**Attack (Nuclear, Conventional, Chemical, and Biological)**  
**Civil Disorder**  
**Dam Failure**  
**Drought**  
**Earthquake**  
**Fires (Structural, Urban and Wild)**  
**Hazardous Materials Release (fixed site and transportation accidents)**  
**Heat Wave**  
**Mass Transportation Accident**  
**Nuclear Power Plants**  
**Public Health Emergencies/Environmental Issues**  
**Riverine Flooding (Major and Flash)**  
**Severe Winter Weather**  
**Special Events**  
**Terrorism**  
**Tornados and Severe Thunderstorms**  
**Utilities**

Missouri, located in the middle region of the United States, is prone to several kinds of natural and anthropogenic hazards. Missouri has a continental climate; weather is changeable and has great variations in temperature and precipitation. Missouri serves as a major thoroughfare for transportation and has an abundant share of industrial, agricultural, and recreational facilities. Thus, human-caused disasters can occur, such as hazardous materials releases, fixed nuclear facility incidents, and other emergencies caused by human action.

Missouri has four topographically distinct regions: glaciated plains in the north, plains or prairie in the west, lowlands in the extreme southeast, and the Missouri Ozark Mountains in between. The plains section, both glaciated and unglaciated, encompasses nearly all of the area north of the Missouri River and a large area south of the river in the western part of the state. The topography varies from rolling hills in the east to hills in the west that average about 450 feet above sea level. There are numerous wide, flat valleys cut by the river. The Ozarks, which comprise about half of the state, are characterized by rugged areas of sharp ridges and deep narrow valleys. Elevations range from about 1,000 to more than 1,600 feet above sea level. The southeastern lowlands cover about 3,000 square miles, with elevations from 230 to 300 feet above sea level. Much of the region is excellent farmland, channeled by an extensive system of drainage ditches. As the state is situated along two of the continent's greatest rivers, the Missouri and the Mississippi Rivers, the potential for great floods is high. While six large flood control dams have been built on the mainstream of the Missouri River, they have not eliminated the flood threat.

Most of the natural disasters that occur in Missouri (except for earthquakes, land subsidence, and possibly dam failures) result from a weather extreme or an extreme weather change. Because Missouri is situated in the center of the United States, it is subject to many different influences that determine weather patterns. Warm and cool air masses often collide along sharply divided "fronts," accompanied by violent thunderstorms having intense rains, strong winds, hail, and occasional tornados. These frontal storm systems can pass across the state at any time of the year, but are most frequent during the spring months (March, April and May). There are two important truths about Missouri's weather: (1) the state is subject to weather extremes, and (2) extreme weather changes can occur rather quickly.

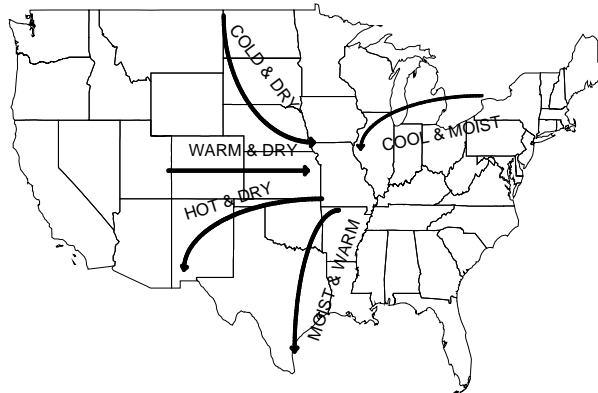
According to Dr. Grant Darkow, Department of Atmospheric Science at the University of Missouri-Columbia, specific recognizable weather patterns are responsible for Missouri's weather, especially those that "tend to produce extremes in precipitation, resulting in unusually wet or drought conditions, and extremes in temperature, either abnormally warm or cold."

Darkow explains, "The character of air over Missouri on any particular day or series of days is dominated by the source regions from which it comes. Missouri's mid-continental location makes it subject to airflows from a variety of source regions with markedly different properties. The state is close enough to the Gulf of Mexico that warm air with high humidity can flow into the state from a southerly direction at almost any time of the year. This warm, moist air is the principal source of spring, summer, and fall precipitation and, occasionally, precipitation in winter as well. In contrast, air arriving over Missouri from semi-arid to arid regions to the southwest is warm or hot and usually dry. Air that has moved from west to east over the Rocky Mountains arrives warm and dry, having lost most of its low-level moisture as it climbed the west side of the mountains. Abnormally cold air in the winter and cold summer air with only

very small moisture content arrives over Missouri from the northwest or north, whereas air entering Missouri from the northeast will tend to be cool and moist.” See **Figure 1**.

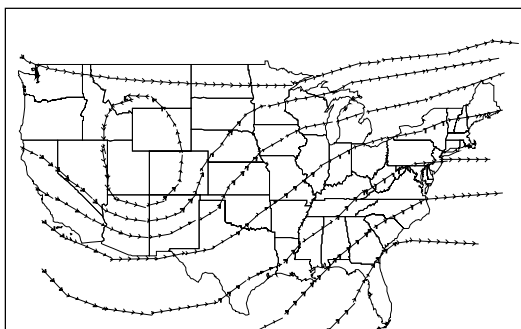
Darkow goes on to explain, “Normally, the flow from one of the principal source regions will last for two or three days before switching to a different direction and source region. These transitions typically are accompanied by a frontal passage during which the change in wind direction, temperature, and moisture content, or any combination, is concentrated.”

**Figure 1. Source Regions And Atmospheric Characteristics For Air Arriving In Missouri**

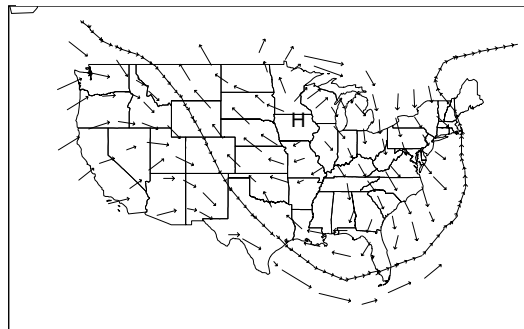


“In some instances, however, a particular flow pattern may be very persistent or dominant for a period of weeks or even months. These periods can lead to wet, dry, hot, or cold spells, and the extremes associated with these periods. These periods are characterized by particular upper air flow patterns and associated surface weather patterns.” See **Figures 2a, 2b, 3a, 3b, 4a, and 4b.**

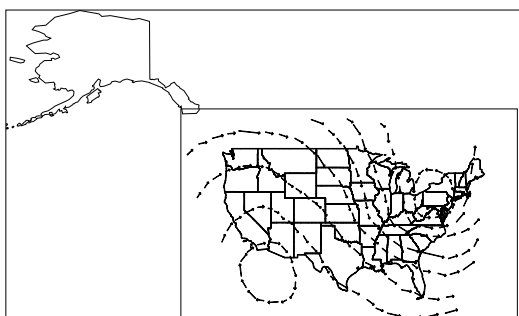
**Figure 2a. Upper Air Pattern  
(Precipitation Producing)**



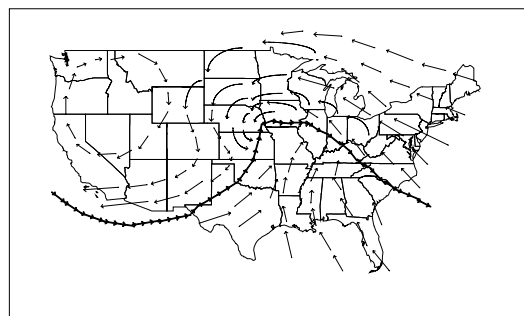
**Figure 2b. Surface Air Pattern  
(Precipitation Producing)**



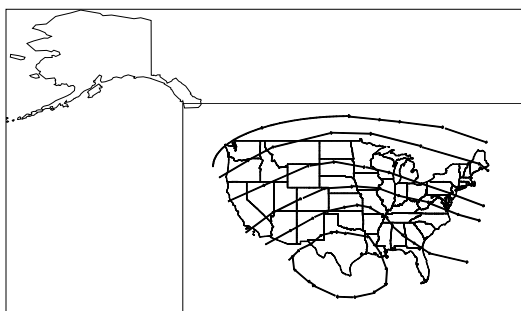
**Figure 3a. Upper Air Pattern  
(Dry To Drought Producing)**



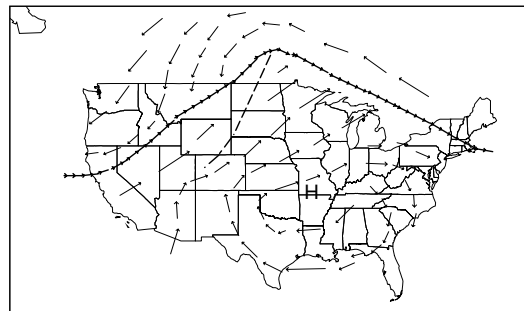
**Figure 3b. Surface Air Pattern  
(Dry to Drought Producing)**



**Figure 4a. Upper Air Pattern  
(Cold-Dry Case)**



**Figure 4b. Surface Air Pattern  
(Cold-Dry Case)**



“The persistence of these weather patterns, and the possible resulting condition is the subject of several of the natural disasters discussed in this study. Specifically, floods, droughts, fires, heat waves, severe cold, and winter storms can be the result of the persistence of one of these weather patterns, whereas tornados can represent the outgrowth of rapid shifts in weather patterns. Knowing these patterns may assist in alerting disaster planners and the general public to the possibility of a developing emergency situation.”

Lately, disasters appear to be occurring more frequently than during previous years. Federal, state, and local emergency managers need to prepare for, respond to, and recover from the



increasing frequency and magnitude of disasters. While recent major disasters are memorable, the increased rate of occurrence is remarkable. Disasters in the 1980s were nearly twice as frequent as disasters in the 1970s. From 1993 through 2000 alone, Missouri experienced seven flood disasters, including one that exceeded the once-in-every-500-years flood levels. According to some weather forecasters, the country has entered a period of extremely destructive weather patterns.

The foundation for emergency preparedness is planning how to handle disasters. The art of perfecting how to respond to disasters is enhanced by the ability to bring together the key players for periodic exercises that emulate actual disasters.

The new millennium has begun, and the emergency management community now faces threats different in many ways than past threats. Gone are the days when emergency management was only for natural disasters and nuclear preparedness. We now face more technologically and politically based hazards that demand the attention of the emergency management community. These new hazards include a number of threats that have not been adequately dealt with in the past, including hazardous materials releases, civil disorders, and terrorism.

This document has been compiled to identify the multitude of hazards that exist at varying locations and degrees of magnitude throughout the state and to determine the potential impacts of these hazards on residents, property, and the environment. The information contained herein identifies capabilities essential to disaster response, for determining the probable effectiveness of allocating resources in emergency situations, and for encouraging the cooperation of various political subdivisions and emergency services in formulating regulations, plans, and programs to mitigate disasters and minimize loss of life, human suffering, and damage to public and private property. In addition, a thorough hazard analysis provides a foundation for educating senior government officials and the public on dangers posed by various hazards.

This section provides general descriptions for each of the hazards that the State of Missouri is susceptible to, along with their hazardous elements.

### **3.1.1 Attack (Nuclear, Conventional, Chemical, and Biological)**

Of all the possible disasters and hazards we can imagine, a strategic nuclear, biological, or chemical attack could be the most devastating and far-reaching in consequences. The use of these weapons against the United States is unlikely. Unfortunately, however, as long as such weapons exist, there is always a chance that they could be used. The potential for traditional war-related attacks, using conventional weapons, is a scenario that is more likely to occur, based on currently available information.

Although the threat of all-out nuclear war has been significantly reduced with the dissolution of the Soviet Union, several scenarios still exist that might subject a jurisdiction to widespread radioactive contamination or high-level radiation exposure. Government officials and other decision makers must remember that the terms of the START II Treaty (passed by the U.S. Senate in 1996), when fully complied with at the end of 10 years from its signing, allows its signatories, Russia and the United States, to maintain 1,000 nuclear weapons each. Also, no one can deny the instability of the Korean peninsula, where nuclear weapons have been developed. Additionally, the Department of Defense estimates that as many as 26 nations may possess

chemical agents or weapons, and an additional 12 may be seeking to develop them. The Central Intelligence Agency reports that at least 10 countries are believed to be conducting research on biological agents for weaponization.

While the threat of nuclear attack has diminished over the past several years, concerns over the use of chemical and biological warfare agents have increased. Recent events, such as the September 11, 2001, terrorist attacks on the World Trade Center buildings in New York City and the Pentagon in Washington D.C., along with follow-up anthrax-related attacks in 2001, have increased awareness of the vulnerability of the U.S. to future attacks involving chemical or biological warfare agents. For more information on terrorist-related issues, see the Terrorism section 3.1.15 of this document.

### **3.1.2 Civil Disorder**

Civil disorder is a term that generally refers to groups of people purposely choosing not to observe a law, regulation, or rule, usually in order to bring attention to their cause, concern, or agenda. In Missouri, state statutes define civil disorder as “any public disturbance involving acts of violence by assemblages of three or more persons, which cause an immediate danger of or results in damage or injury to the property or person of any other individual.”

Civil disorders can take the form of small gatherings or large groups blocking or impeding access to a building, or disrupting normal activities by generating noise and intimidating people. They can range from a peaceful sit-in to a full-scale riot in which a mob burns or otherwise destroys property and terrorizes individuals. Even in its more passive forms, a group that blocks roadways, sidewalks, or buildings interferes with public order. In the 1990s, abortion clinics, for example, were targets for these disruptive-type activities.

Throughout this country’s history, incidents that disrupted the public peace have figured prominently. The Constitutional guarantees allow for ample expression of protest and dissent, and in many cases collide with the Preamble’s requirement of the government “to ensure domestic tranquility.” Typical examples of such conflicting ideology include the protest movements for civil rights in the late 1960s and the Vietnam War protest demonstrations in the mid-1970s. The balance between an individual’s or group’s legitimate expression of dissent and the right of the populace to live in domestic tranquility requires the diligent efforts of everyone to avoid such confrontations in the future.

In modern society, laws have evolved that govern the interaction of its members to peacefully resolve conflict. In the United States, a crowd itself is constitutionally protected under “the right of the people to peacefully assemble.” However, assemblies that are not peaceable are not protected, and this is generally the dividing line between crowds and mobs. The laws that deal with disruptive conduct are generally grouped into offenses that disturb the public peace. They range from misdemeanors such as blocking sidewalks or challenging another to fight, to felonies such as looting and rioting. Missouri law makes “promoting civil disorder in the first degree” a class C felony, according to Section 574.070 of the Revised Missouri Statutes. As stated in one provision of the law, “Whoever teaches or demonstrates to any other person the use, application, or construction of any firearm, explosive, or incendiary device capable of causing injury or death to any person, knowing or intending that such firearm, explosive or incendiary device be used in furtherance of a civil disorder, is guilty of promoting civil disorder in the first degree.”

## Types of Crowds and Mobs

A crowd may be defined as a casual, temporary collection of people without a strong, cohesive relationship. Crowds can be classified into four general categories:

- **Casual Crowd** – A casual crowd is merely a group of people who happen to be in the same place at the same time. Examples of this type include shoppers and sightseers. The likelihood of violent conduct is all but nonexistent.
- **Cohesive Crowd** – A cohesive crowd consists of members who are involved in some type of unified behavior. Members of this group are involved in some type of common activity such as worshiping, dancing, or watching a sporting event. Although they may have intense internal discipline (e.g. rooting for a team), they require substantial provocation to arouse to action.
- **Expressive Crowd** – An expressive crowd is one held together by a common commitment or purpose. Although they may not be formally organized, they are assembled as an expression of common sentiment or frustration. Members wish to be seen as a formidable influence. One of the best examples of this type is a group assembled to protest something.
- **Aggressive Crowd** – An aggressive crowd is comprised of individuals who have assembled for a specific purpose. This crowd often has leaders who attempt to arouse the members or motivate them to action. Members are noisy and threatening and will taunt authorities. They tend to be impulsive and highly emotional and require only minimal stimulation to arouse them to violence. Examples of this type of crowd include demonstrations and strikers.

A mob can be defined as a large disorderly crowd or throng. Mobs are usually emotional, loud, tumultuous, violent, and lawless. Like crowds, mobs have different levels of commitment and can be classified into four categories:

- **Aggressive Mob** – An aggressive mob is one that attacks, riots, and terrorizes. The object of violence may be a person, property, or both. An aggressive mob is distinguished from an aggressive crowd only by lawless activity. Examples of aggressive mobs are the inmate mobs in prisons and jails, mobs that act out their frustrations after political defeat, or violent mobs at political protests or rallies.
- **Escape Mob** – An escape mob is attempting to flee from something such as a fire, bomb, flood, or other catastrophe. Members of escape mobs have lost their capacity to reason and are generally impossible to control. They are characterized by unreasonable terror.
- **Acquisitive Mob** – An acquisitive mob is one motivated by a desire to acquire something. Riots caused by other factors often turn into looting sprees. This mob exploits a lack of control by authorities in safeguarding property. Examples of acquisitive mobs would include the looting in South Central Los Angeles in 1992, or food riots in other countries.
- **Expressive Mob** – An expressive mob is one that expresses fervor or revelry following some sporting event, religious activity, or celebration. Members experience a release of pent up emotions in highly charged situations. Examples of this type of mob include the June 1994 riots in Canada following the Stanley Cup professional hockey championship,

European soccer riots, and those occurring after other sporting events in many countries, including the United States.

Although members of mobs have differing levels of commitment, as a group they are far more committed than members of a crowd. As such, a “mob mentality” sets in, which creates a cohesiveness and sense of purpose that is lacking in crowds. Thus, any strategy that causes individual members to contemplate their personal actions will tend to be more effective than treating an entire mob as a single entity.

### 3.1.3 Dam Failure

Over the years, dam failures have injured or killed thousands of people and caused billions of dollars of property damage in the United States. Among the most catastrophic were the failures of the Teton Dam in Idaho in 1976, which killed 14 people and caused more than \$1 billion in damage, and the Kelly-Barnes Dam in Georgia, which left 39 dead and \$30 million in property damage. In the past few years, over 200 documented dam failures occurred nationwide causing four deaths and millions in property damage and repair costs. The problem of unsafe dams in Missouri was underscored by dam failures at Lawrenceton in 1968, Washington County in 1975, Fredricktown in 1977, and a near failure in Franklin County in 1979. More recently, a severe rainstorm and flash flooding in October 1998 compromised about a dozen small, unregulated dams in the Kansas City area. Overall, many of Missouri’s smaller dams are becoming a greater hazard as they continue to age and deteriorate. While hundreds of them need to be rehabilitated, lack of funding and questions of ownership loom as obstacles.

A dam is defined by the National Dam Safety Act as an artificial barrier that impounds or diverts water and (1) is more than 6 feet high and stores 50 acre feet or more, or (2) is 25 feet or more high and stores more than 15 acre feet. Based on this definition, there are over 80,000 dams in the United States. Over 95 percent of these dams are non-federal, with most being owned by state governments, municipalities, watershed districts, industries, lake associations, land developers, and private citizens. Dam owners have primary responsibility for the safe design, operation, and maintenance of their dams. They also have responsibility for providing early warning of problems at the dam, for developing an effective emergency action plan, and for coordinating that plan with local officials. The State has ultimate responsibility for public safety; many states regulate construction, modification, maintenance, and operation of dams, and also implement a dam safety program.

Dams can fail for many reasons. The most common are as follows:

- **Piping:** Internal erosion caused by embankment leakage, foundation leakage and deterioration of pertinent structures appended to the dam.
- **Erosion:** Inadequate spillway capacity causing overtopping of the dam, flow erosion, and inadequate slope protection.
- **Structural Failure:** Caused by an earthquake, slope instability or faulty construction.

These three types of failures are often interrelated. For example, erosion, either on the surface or internal, may weaken the dam and lead to structural failure, whereas a structural failure may

shorten the seepage path and lead to a piping failure. Observable defects that provide good evidence of potential dam failures are illustrated in Section 3.2.3.

Dam construction varies widely throughout the state. Most dams are of earthen construction. Missouri's mining industry has produced numerous tailing dams for the surface disposal of mine waste. These dams are made from mining material deposited in slurry form in an impoundment. Other types of earthen dams are reinforced with a core of concrete or asphalt. The largest dams in the state are built of reinforced concrete and are used for hydroelectric power.

### 3.1.4 Drought

Drought is not a hazard that affects just farmers, but can impact the nation's entire economy. Its outcome can adversely affect a small town's water supply, the corner grocery store, commodity markets, and tourism. According to the National Drought Mitigation Center, drought costs the U.S. economy about \$7 to \$9 billion dollars a year. Losses from the Great Drought of 1988-1989 have been assessed at \$39 billion.

The dictionary defines drought as a period of prolonged dryness. The Missouri Drought Response Plan distinguishes between five "categories" of drought, as follows:

1. **Agricultural Drought**, defined by soil moisture deficiencies;;
2. **Hydrological Drought**, defined by declining surface and groundwater supplies;
3. **Meteorological Drought**, defined by precipitation deficiencies;
4. **Hydrological Drought & Land Use**, defined as a meteorological drought in one area that has hydrological impacts in another area; and
5. **Socioeconomic Drought**, defined as drought that impacts supply and demand of some economic commodity.

Each of these definitions relates the occurrence of drought to water shortfall in some component of the hydrological cycle. Each affects patterns of water and land use, and each refers to a repetitive climatic condition. In urban areas, drought can affect those communities that depend on reservoirs for water, and decreased water levels due to insufficient rain can lead to restricted water use. In agricultural areas, drought during the planting and growing season can have a significant impact on yield. The U.S. Government's definition of an agricultural drought incorporates specific parameters based on historical records. Agricultural drought is "a combination of temperature and precipitation over a period of several months leading to a substantial reduction in yield (bushels per acre) of one or more of the three major food grains (wheat, soybean, corn). A substantial reduction is defined as a yield (bushels per acre) less than 90% of the yield expected with temperature/precipitation equal to long term average values."

Regardless of the specific definition, droughts are difficult to predict or forecast, both as to when they will occur and how long they will last. According to Dr. Grant Darkow, Department of Atmospheric Science, University of Missouri-Columbia, there is a recognizable "upper air-flow pattern and simultaneous surface pattern associated with abnormal dryness over Missouri." When the upper air-flow pattern is typified by air flowing in a broad arc over the central plains with higher speeds in southern Canada than over the U.S., then the air over the southern plains will be "characterized by a weak clockwise circulation." Storm systems coming off the Pacific

Ocean will cross the extreme northwestern states and southern Canada, thus bypassing the Midwestern states. When this flow pattern persists, the result can be a prolonged period of drought.

The most commonly used indicator of drought and drought severity is the Palmer Drought Severity Index (PDSI), which is published jointly by the National Oceanic and Atmospheric Administration (NOAA) and the U.S. Department of Agriculture (USDA) (see **Table 1**). The PDSI measures the difference between water supply (in terms of precipitation and stored soil moisture) and demand (the amount of water required to recharge soil and keep rivers, lakes and reservoirs at normal levels). The result is a scale from +4 to -4, at 1.0 and 0.5 intervals. By relating the PDSI to a regional index, one can compile data that reflects long-term wet or dry tendencies.

**Table 1. Palmer Drought Severity Index (PDSI)**

PDSI Number	Long-Term Tendency
Above 4.0	Extreme moist spell
3.0 to 3.9	Very moist spell
2.0 to 2.9	Unusually moist spell
1.0 to 1.9	Moist spell
0.5 to 0.9	Incipient moist spell
0.4 to -0.4	Near normal conditions
-0.5 to -0.9	Incipient drought
-1.0 to -.9	Mild drought
-2.0 to -2.9	Moderate drought
-3.0 to -3.9	Severe drought
Below -4.0	Extreme drought



For PDSI reporting purposes, Missouri is divided into six regions of similar climatic conditions: Northwest, Northeast, West Central, Southwest, Southeast, and Bootheel. These regions are illustrated in **Figure 5** (Palmer Drought Severity Index, Missouri Subregions).

**Figure 5. Palmer Drought Severity Index, Missouri Subregions**  
In addition to the NOAA/USDA indices, water management agencies in Missouri have access to the Missouri Crop and Weather Report, produced by the Missouri Agricultural Statistics Service. These reports provide detailed statistical

information on weather conditions, crop conditions, topsoil moisture supply, and subsoil moisture supply by subregion throughout Missouri.

Other less quantitative indicators of drought include high water demand versus available supplies, reduced stream flows, declining reservoir levels, precipitation deficits, falling water levels in wells, and low soil moisture.

The difficulty with recognizing or predicting drought is that no single indicator can be reliably used to predict onset. Regional indicators such as the PDSI are limited in that they respond slowly to deteriorating conditions, whereas observations of surface conditions and groundwater measurements or rainfall may only provide a “snapshot” of a very small area. Consequently, the use of a variety of drought indicators is essential for effective assessment of drought conditions, and the PDSI is the primary means to assess drought severity.

Missouri’s Drought Response System is divided into four phases:

1. **Phase I – Advisory Phase:** Requires a drought monitoring and assessment system to provide enough lead-time for state and local planners to take appropriate action.
2. **Phase II – Drought Alert:** When the PDSI reads -1.0 to -2.0, and stream flows, reservoir levels, and groundwater levels are below normal over a several month period, or when the Drought Assessment Committee (DAC) determines that Phase II conditions exist based on other drought determination methods.
3. **Phase III – Conservation Phase:** When the PDSI reads -2.0 to -4.0, and stream flows, reservoir levels, and groundwater levels continue to decline, along with forecasts indicating an extended period of below-normal precipitation, or when the DAC determines that Phase III conditions exist based on other drought determination models.
4. **Phase IV – Drought Emergency:** When the PDSI is lower than -4.0, or when the DAC determines that Phase IV conditions exist based on other drought determination methods.

### 3.1.5 Earthquake

Earthquakes are defined as shifts in the earth's crust causing the surface to become unstable. This instability can manifest itself in intensity from slight tremors to large shocks. The duration can be from a few seconds up to 5 minutes. The period of tremors (and shocks) can last up to several months. The larger shocks can cause ground failure, landslides, liquefaction, uplifts, and sand blows.

The earth's crust is made up of gigantic plates, commonly referred to as tectonic plates. These plates form what is known as the lithosphere, which varies in thickness from 6.5 miles (beneath oceans) to 40 miles (beneath mountain ranges), and has an average thickness of 20 miles. These plates “float” over a partly melted layer of crust called the asthenosphere. The plates are in motion, and areas where one plate joins another are referred to as “plate boundaries.” Areas where the plates are moving toward each other are called convergent plate boundaries, and areas when they are moving away from each other are called divergent plate boundaries. The North American Plate moves generally from east to west on the east coast, due to the divergent nature of the spreading pressures of the Mid-Atlantic Ridge; while on the west coast, the San Andreas Fault in California is a horizontal motion transform boundary, moving somewhat southward due

to the relative northward motion of the Pacific plate. These movements release built-up energy in the form of earthquakes, tremors, and volcanic activity. Fault lines such as the San Andreas come all the way to the surface and can be readily seen and identified. Some fault lines do not come all the way to the surface, yet they can store and release energy when they move. Many of the faults in the central United States are characterized this way.

The subterranean faults were formed many millions of years ago on or near the surface of the earth. Subsequent to that time, these ancient faults subsided, while the adjacent areas were pushed up. As this fault zone (also known as a rift) lowered, sediments filled in the lower areas. Under pressure, sediments hardened into limestones, sandstones, and shales, thus burying the rifts. With the pressure on the North Atlantic ridge affecting the eastern side of the North American plate, and the movements along the San Andreas Fault by the Pacific plate, the buried rift system in the Mississippi embayment has been reactivated. This particular rift system is now called the Reelfoot Rift.

Eight earthquake source zones are located in the central United States, two of which are located within the State of Missouri. The most active zone is the New Madrid Fault, which runs from northern Arkansas through southeast Missouri and western Tennessee and Kentucky to the Illinois side of the Ohio River Valley. Other zones, because of their close proximity, also affect Missourians. These are the Wabash Valley Fault, Illinois Basin, and the Nemaha Uplift.

The Nemaha Uplift is of concern to Missourians because it runs parallel to the Missouri/Kansas border from Lincoln, Nebraska, to Oklahoma City, Oklahoma. Though earthquakes from the Nemaha Uplift are not as severe as those associated with the historic New Madrid fault zone, several earthquakes have affected Missouri in the past.

The Modified Mercalli Intensity Scale is a numerical index scale to describe the effects of an earthquake on the surface of the Earth, on man, and on man-made structures (**Figure 6**). Further discussion on this is included following the scale legend. **Figure 7** shows projected earthquake intensities for magnitude 6.7, 7.6 and 8.6 earthquakes.



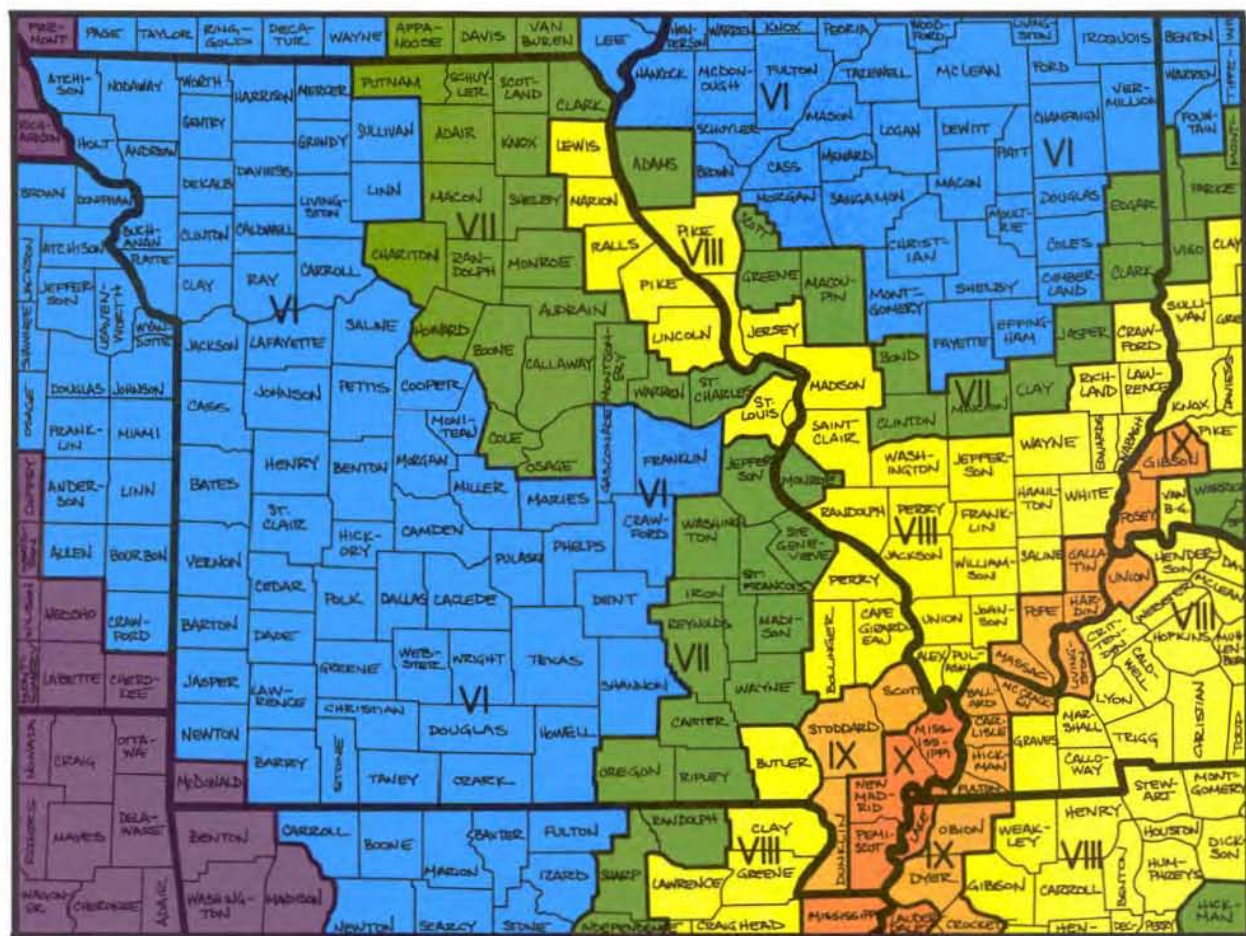
Figure 6. Modified Mercalli Intensity Scale

MODIFIED MERCALLI INTENSITY SCALE	
I	People do not feel any Earth movement.
II	A few people might notice movement.
III	Many people indoors feel movement. Hanging objects swing.
IV	Most people indoors feel movement. Dishes, windows, and doors rattle. Walls and frames of structures creak. Liquids in open vessels are slightly disturbed. Parked cars rock.
V	Almost everyone feels movement. Most people are awakened. Doors swing open or closed. Dishes are broken. Pictures on the wall move. Windows crack in some cases. Small objects move or are turned over. Liquids might spill out of open containers.
VI	Everyone feels movement. Poorly built buildings are damaged slightly. Considerable quantities of dishes and glassware, and some windows are broken. People have trouble walking. Pictures fall off walls. Objects fall from shelves. Plaster in walls might crack. Some furniture is overturned. Small bells in churches, chapels and schools ring.
VII	People have difficulty standing. Considerable damage in poorly built or badly designed buildings, adobe houses, old walls, spires and others. Damage is slight to moderate in well-built buildings. Numerous windows are broken. Weak chimneys break at roof lines. Cornices from towers and high buildings fall. Loose bricks fall from buildings. Heavy furniture is overturned and damaged. Some sand and gravel stream banks cave in.
VIII	Drivers have trouble steering. Poorly built structures suffer severe damage. Ordinary substantial buildings partially collapse. Damage slight in structures especially built to withstand earthquakes. Tree branches break. Houses not bolted down might shift on their foundations. Tall structures such as towers and chimneys might twist and fall. Temporary or permanent changes in springs and wells. Sand and mud is ejected in small amounts.
IX	Most buildings suffer damage. Houses that are not bolted down move off their foundations. Some underground pipes are broken. The ground cracks conspicuously. Reservoirs suffer severe damage.
X	Well-built wooden structures are severely damaged and some destroyed. Most masonry and frame structures are destroyed, including their foundations. Some bridges are destroyed. Dams are seriously damaged. Large landslides occur. Water is thrown on the banks of canals, rivers, and lakes. Railroad tracks are bent slightly. Cracks are opened in cement pavements and asphalt road surfaces.
XI	Few if any masonry structures remain standing. Large, well-built bridges are destroyed. Wood frame structures are severely damaged, especially near epicenters. Buried pipelines are rendered completely useless. Railroad tracks are badly bent. Water mixed with sand, and mud is ejected in large amounts.
XII	Damage is total, and nearly all works of construction are damaged greatly or destroyed. Objects are thrown into the air. The ground moves in waves or ripples. Large amounts of rock may move. Lakes are dammed, waterfalls formed and rivers are deflected.

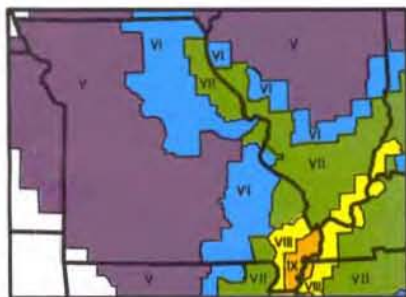
Intensity is a numerical index describing the effects of an earthquake on the surface of the Earth, on man, and on structures built by man. The intensities shown in these maps are the highest likely under the most adverse geologic conditions. There will actually be a range in intensities within any small area such as a town or county, with the highest intensity generally occurring at only a few sites. Earthquakes of all three magnitudes represented in these maps occurred during the 1811 - 1812 "New Madrid earthquakes." The isoseismal patterns shown here, however, were simulated based on actual patterns of somewhat smaller but damaging earthquakes that occurred in the New Madrid seismic zone in 1843 and 1895.

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**Figure 7. Projected Earthquake Intensities (6.7, 7.6 and 8.6)**

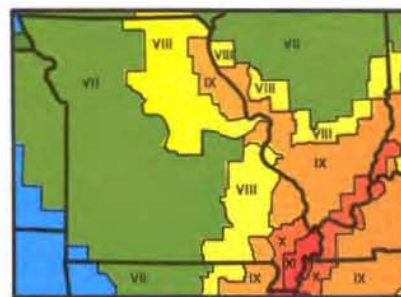


This map shows the highest projected Modified Mercalli intensities by county from a potential magnitude – 7.6 earthquake whose epicenter could be anywhere along the length of the New Madrid seismic zone.



This map shows the highest projected Modified Mercalli intensities by county from a potential magnitude – 6.7 earthquake whose epicenter could be anywhere along the length of the New Madrid seismic zone.

This map shows the highest projected Modified Mercalli intensities by county from a potential magnitude – 8.6 earthquake whose epicenter could be anywhere along the length of the New Madrid seismic zone.



**NOTE:** The Missouri Projected Modified Mercalli Earthquake Intensity map is intended for planning and education purposes. It is not intended to be used for design or construction purposes. Intensities are depicted countywide, when in reality intensities would vary within each county depending on geologic structures, proximity to the actual earthquake epicenter, etc.

### **3.1.6 Fires (Structural, Urban and Wild)**

Fires can range in scope to include structural, urban, and wild fires. For the purpose of this analysis, structural and urban fires are considered in one category, with wild fires, including forest, prairie, and grassland locations, considered separately.

Structural fires are a major problem that can affect any area of the state. The Missouri Division of Fire Safety (MDFS) indicates that approximately 80 percent of the fire departments in Missouri are staffed with volunteers dedicated to the task of fire prevention and suppression. Whether paid or volunteer, these departments are often limited by lack of resources and financial assistance. The impact of a fire to a single-story building in a small community may be as great as that of a larger fire to a multi-story building in a large city.

Because fires can occur anywhere in the state, the MDFS has actively promoted the enactment of a statewide fire code. Although no statewide code has been enacted to date, successful legislative efforts to improve fire safety have included the following:

1. Fire, Safety, Health, and Sanitation Inspections of Child Care Facilities (RSM 210.252)
2. Boiler and Pressure Vessel Safety Act (RSM 650.200)
3. Elevator Safety Act (RSM 701.350).

Fires impact many aspects of society in terms of economic, social, and other indirect costs. According to the MDFS, the most costly crime in the state is arson. This should be a great concern to citizens, law enforcement, the judicial system, and the fire service sector. Fires caused by arson impact citizens through higher insurance premiums, lost jobs, loss of lives, injuries, and property loss. Primary duties of the Missouri State Fire Marshal include the investigation of fires, explosions, and any related occurrences. The investigative staff is responsible for investigating any fire requested by fire service and law enforcement within the state. This also includes explosions, bombings, and all other related offenses.

Presently, the MDFS investigative staff includes 1 deputy chief, 2 regional chiefs, and 18 field investigators. This staff must cover all 114 counties and is dedicated to assisting any local or state agency and conducting quality investigations. The investigators are trained in several fields of expertise, including arson for fraud, explosives recognition, and post-blast training. The Division uses four canines, including three specifically trained in accelerant detection and one in explosives detection.

The MDFS Training Unit develops and oversees the training curriculum being provided regionally for state certification of fire fighters, fire investigators, fire inspectors, and fire service instructors. Although fire fighter certification is not mandatory in Missouri, currently over 15,000 individuals are certified by the MDFS.

Also, the MDFS has initiated a statewide mutual aid system. This system enhances the ability of rural (volunteer) or city (paid) fire departments to handle major fires within their jurisdictions. To compliment the statewide mutual aid system, an incident management system (IMS) overhead team concept has been developed throughout the state. This should assist the rural and



city fire departments in the management of a major fire disaster. **Figure 8** shows the Fire/Rescue Mutual Aid Regions in Missouri.

The MDFS is responsible for the enforcement of fireworks laws throughout Missouri. In addition to conducting inspections of any facilities involved with fireworks, approximately 1,350 permits are issued yearly to manufacturers, wholesalers, and retailers of fireworks. Illegal fireworks are a concern because they can be dangerous, causing loss of lives, severe injuries, and property damage.

The Forestry Division of the Missouri Department of Conservation (MDC) is responsible for protecting privately-owned and state-owned forests and grasslands from the destructive effects of wildfires. To accomplish this task, eight forestry districts have been established in the state to assist with the quick suppression of fires (see **Figure 9**). The Forestry Division works closely with Volunteer Fire Departments and Federal partners to assist with fire suppression activities. Currently, more than 900 rural fire departments have mutual aid agreements with the Forestry Division to obtain assistance in wildfire protection if needed; a cooperative agreement with the Mark Twain National Forest is renewed annually. **Figure 10** illustrates the 12 Mark Twain National Forests across Missouri.

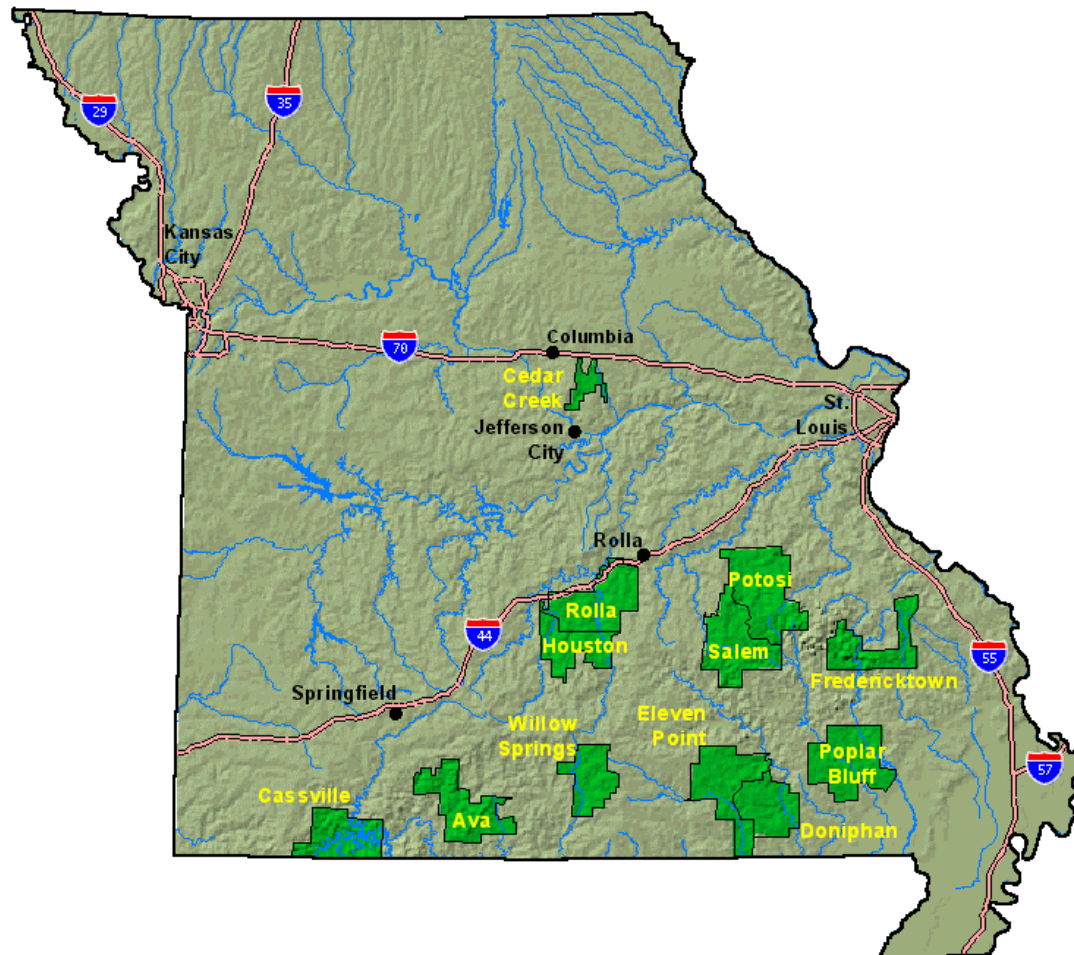
**Figure 8. Missouri Fire And Mutual Aid Regions**



**Figure 9. Missouri Department of Conservation Forestry Districts**



**Figure 10. Mark Twain National Forests**



Forest and grassland fires can occur any day throughout the year. Each year, an average of about 3,700 wildfires burn more than 55,000 acres of forest and grassland in Missouri. Most of the fires occur during the spring season, normally between February 15 and May 10. The length and severity of burning periods largely depend on the weather conditions. Spring in Missouri is noted for its low humidity and high winds. These conditions, together with below-normal precipitation and high temperatures, result in extremely high fire danger. In addition, due to the continued lack of moisture throughout many areas of the state, conditions are likely to increase the risk of wildfires. Drought conditions can also hamper fire-fighting efforts, as decreasing water supplies may not provide for adequate fire fighting suppression. Spring is when many rural residents burn their garden spots, brush piles, and other areas. Many landowners also believe it is necessary to burn their forests in the spring to promote grass growth, kill ticks, and reduce brush. Therefore, with the possibility of extremely high fire dangers and the increased opportunities for fires, the spring months are the most dangerous for wildfires. The second most critical period of the year is fall. Depending on the weather conditions, a sizeable number of fires may occur between mid-October and late November.

### **3.1.7 Hazardous Materials Release (fixed site and transportation accidents)**

A hazardous material is any substance or material in a quantity or form that may pose a reasonable risk to health, the environment, or property. The category Hazardous Materials includes incidents involving substances such as toxic chemicals, fuels, nuclear wastes and/or products, and other radiological and biological or chemical agents. For the purposes of this hazard analysis section, only accidental or incidental releases of hazardous materials from two different kinds of incidents are addressed: fixed facility incidents and transportation-related accidents. In consideration of recent worldwide and national events, incidents involving terrorism or national attacks, which involve hazardous materials of any type, are addressed in the Terrorism, Attack, and Special Events Considerations (see Sections 3.15, 3.2.1, and 3.2.14, respectively).

Generally with a fixed facility, the hazards are pre-identified, and the facility is required by law to prepare a risk management plan and provide a copy of this plan to the local emergency planning commission (LEPC) and local fire departments. Missouri Tier II forms must also be filed with the Missouri Emergency Response Commission (MERC) at SEMA. A list of all facilities that have filed Tier II forms is on file with SEMA, Hazardous Materials Program Manager. For specific site plans, each county LEPC is required by law to maintain a copy of these plans.

The exact location of a hazardous materials accident is impossible to predict. The close proximity of railroads, highways, waterways, and industrial facilities to populated areas, schools, and businesses could put a large number of individuals in danger at any time. In addition, essential service facilities, such as police and fire stations, hospitals, nursing homes, and schools near major transportation routes in the state are also at risk from a potential hazardous materials incident.

Federal Highway Administration statistics indicate that 1 of 10 motor vehicles is engaged in the transport of hazardous materials of some type. The USACE also indicates that over 9,000 tons of petroleum products and over 200,000 tons of chemicals and related products are shipped annually by river barge via the Missouri River between Omaha and Kansas City. Previous estimates have indicated that nationwide, over 4 billion tons of hazardous materials are shipped each year by various transportation modes. Approximately 20 flights each day out of Lambert Airport in St. Louis carry nuclear medicines, and Tri-State Motor Transit Company of Joplin has approximately 25 shipments of high explosives each week.

Missouri is also at risk because of the highway system and geographical location. With Interstate highways such as I-29, I-35, I-44, I-55 and I-70, Missouri offers premium routes for commercial carriers traversing the continental United States. Even arterial highways in Missouri, such as U.S. Highways 71, 13, 63, 54, and 61 are maintained to provide more favorable traveling conditions than in other central states. Also, the locations of nuclear facilities in relation to mines and fuel processing plants result in shipments of radioactive products and wastes across Missouri.

Missouri is at the crossroads for rail and truck transport of nuclear waste to the Yucca Mountain, Nevada, test site. Truck shipments alone will affect 25 different states, 266 counties, and two

Indian Reservations. This will be a potentially large waste shipping campaign from as many as 19 nuclear reactors through other corridor states to Nevada.

The railroad systems in Missouri transport voluminous types and amounts of hazardous materials on their 6,351 miles of rails that transverse the state. Though individual cars may be placarded to reveal contents such as hazardous materials, only estimates can be obtained concerning volumes of such materials, because only the interstate traffic is counted or measured. Interstate shipments are accounted for where they originate and terminate.

Increased use and transport of materials across the country has created serious problems for emergency services personnel. Many factors can increase the magnitude of an otherwise simple transportation accident into an incident of potential hazard to high numbers of people.

Following are potential factors to be considered:

- Over 14,000 different chemicals are estimated as being shipped by the various transportation modes.
- Some types of highly toxic chemicals do not require placarding if shipped in quantities of less than 1,000 pounds, even though lesser quantities could devastate a small town.
- Only a few emergency response organizations in the larger cities and counties near the more metropolitan areas have had training for handling peacetime radiological problems, and very few have adequate training.
- There is a general lack of intelligence reports regarding activity of possible terrorists.

Other scenarios involve nuclear terrorism and faulty re-entry of nuclear-equipped satellites to earth (such as COSMOS 954 in 1978 and SKYLAB in 1980). However, transport of radioactive materials presents the most probable scenario for a radiological incident. The Department of Energy is currently shipping by rail radioactive waste to a repository near Salt Lake City, Utah. These trains cross Missouri through St. Louis and Kansas City on the Union Pacific (UP) tracks. The federal government has finalized development of long-term repositories for spent fuel and other high-level radioactive wastes, and for transuranics (known as TRU waste), at Yucca Mountain, Nevada, and Carlsbad, New Mexico, respectively. Speculations have suggested that up to 3,600 shipments per year may go to these facilities, depending on several variables.

Missouri is a transportation hub. The Interstate corridors of I-44, I-70 and I-55 are the most commonly used for truck transport. U.S. Highway 36 crosses the northern counties, while U.S. 60 crosses the southern counties. U.S. Highways 71, 13, 65, and 63 are also well-traveled north-south arterial routes. Although there are railroads throughout Missouri, the UP route between St. Louis and Kansas City is the most used for large radioactive material shipments. The switching yards at St. Louis and Kansas City process more of these transcontinental trains than any other yards in the country.

A large number of hazardous material shipments come from two corporations in Missouri. Tyco/Mallinckrodt Medical in Maryland Heights (St. Louis County) and Tri-State Motor Transit in Joplin (Jasper County). Tyco/Mallinckrodt Medical is one of the largest manufacturers of radiopharmaceuticals in the world. Tri-State is one of the largest single private carriers of



radioactive materials in the world, in addition to transporting all classes of explosive materials and other toxic and hazardous materials.

During any radiological emergency, regardless of the cause, local officials and emergency responders will likely require state or federal support in the detection, monitoring, and analysis of radiological data for decision-making.

In 1990, the Agency for Toxic Substances and Disease Registry (ATSDR) of the Centers for Disease Control and Prevention (CDC) began funding selected state health departments to participate in the Hazardous Substances Emergency Events Surveillance (HSEES) system. Missouri was added to this effort in fiscal year 1994 and became the twelfth participating state. Missouri's HSEES participation is administered by the Missouri Department of Health and Senior Services (MDHSS). The goal of this surveillance project is to provide data in an effort to reduce injuries and deaths to first responders, employees, and the general public from hazardous substance emergencies.

A hazardous substance release (or "event") is entered into the HSEES system if it meets either of the following criteria:

The substances that are actually released or threaten to be released include hazardous substances (except petroleum products), and the hazardous substances released, or are threatened to be released, need (or would need) to be removed, cleaned up, or neutralized in accordance with federal, state, or local law;

-OR-

Only a threatened release of hazardous substances exists, but this threat leads to an action, such as an evacuation, due to the potential impact on the health of employees, responders or the general public. This action makes the event eligible for inclusion in the surveillance system, even though hazardous substances are not actually released.

Data collection for the Missouri HSEES system began October 1, 1993. Reports of hazardous substance releases in Missouri come from a variety of sources, including the Missouri Department of Natural Resources (MDNR), the Missouri State Highway Patrol, Missouri Division of Fire Safety, Missouri Occupational Fatality Assessment & Control Evaluation (MOFACE) program, SEMA, and media reports. The MDNR Air and Land Protection Division (ALPD) Environmental Emergency Response (EER) Section is the primary notification source for Missouri's HSEES program.

In the event of an incident, the HSEES coordinator contacts company officials, police and fire department personnel, victims, and others involved to obtain the maximum amount of information about the event. Then, an incident report form is completed. The form includes the following information:

- Where and when the event occurred, including whether the event took place at a fixed facility or during the transport of the substance;
- Weather conditions, time, and day of the week when the event occurred;
- Substances and quantity released or threatened to be released;

- Data related to possible exposure, such as proximity to residential areas; the primary use of nearby land (e.g., commercial, industrial, agricultural or residential); the number of people living within 0.25, 0.5 and 1 mile of the event; how many people were at home when the release took place; evacuations required (if any), and number of people affected; and
- Deaths and injuries that resulted from the event, including who was injured (e.g., employees, general public, responders), the number and severity of injuries, and steps that could have been taken to prevent deaths or injuries (e.g., type of personnel protective equipment that the injured used, or other protective measures, such as evacuations).

During calendar year 2001, local, state, and federal officials reported 2,130 seizures of methamphetamine (meth) production laboratories, related dumping sites, and locations of inactive labs in Missouri—more than any other state in the nation. A recent local media report indicated that this trend is continuing in Missouri, with over 2,700 meth labs reports submitted to law enforcement officials in 2002. The prevalence of meth labs in the state, and potential for injuries to responders and the general public, demanded that additional data be gathered about the public health impact of meth-related activities. Therefore, events relating to meth production are included in the HSEES system reporting, if they meet the inclusion criteria.

### 3.1.8 Heat Wave

A heat wave is a period of excessive heat, which can lead to illness and other stress to people with prolonged exposure to these conditions. High humidity, which often accompanies heat in Missouri, can make the effects of heat even more harmful. While heat-related illness and death can occur from exposure to intense heat in just one afternoon, heat stress on the body has a cumulative effect. Consequently, the persistence of a heat wave increases the threat to public health. Heat waves are often a major contributing factor to power outages (brownouts, etc.), as the high temperatures result in a tremendous demand for electricity for cooling purposes. Power outages for prolonged periods increase the risk of heat stroke and subsequent fatalities due to loss of cooling and proper ventilation.

Other related hazards include water shortages brought on by drought-like conditions and high demand. Local advisories, which list priorities for water use and rationing, are common during heat waves. Government authorities report that civil disturbances and riots are also more likely to occur during heat waves, as well as incidents of domestic violence and abuse. Along with humans, high temperatures and humidity also can affect animals. For instance, cattle and other farm animals respond to heat by reducing feed intake, increasing their respiration rate, and increasing their body temperature. These responses assist the animal in cooling itself, but this is usually not sufficient. The hotter the animal is, the more it will begin to shut down body processes not vital to its survival, such as milk production, reproduction, or muscle (meat) building.

The National Weather Service (NWS) defines a heat wave as three consecutive days of temperatures of 90 degrees Fahrenheit (°F) and above. These high temperatures generally occur from June through September, but are most prevalent in the months of July and August. Missouri experiences about 40 days per year above 90 °F, based on a 30-year average compiled by the NWS from 1961 through 1990. July leads this statewide mean with 15 days above 90 °F, followed by August with an average of 12 days over 90 F. June and September average 6 days and 4 days, respectively, for temperatures above 90 °F. The 30-year climatic data is from NWS stations at Kansas City, Columbia, Springfield, and St. Louis. As these regional locations indicate, all of Missouri is subject to heat wave during the summer months.

Ambient temperature, relative humidity, duration of exposure, wind, and activity should be considered when assessing the likely effects of heat. The NWS has increased its efforts to more effectively alert the general public and appropriate authorities to the hazards of heat waves—those prolonged episodes of excessive heat and humidity. The NWS has devised a Heat Index (HI), which is a combination of air temperature and relative humidity that more accurately reflects the heat intensity. The HI, given in degrees Fahrenheit, is an accurate measure of how hot it really feels when the relative humidity (RH) is added to the actual air temperature. The Heat Index Chart is shown in **Figure 11**. As an example, if the air temperature is 96 °F (found on the left side of the table), and the relative humidity is 55% (found at the top of the table), the HI is 112 °F (the intersection of the 96° row and the 55% column). Because HI values were devised for shady, light wind conditions, exposure to full sunshine can increase HI values by up to 15 °F. Also, strong winds, particularly with very hot, dry air, can be extremely hazardous.

**Figure 11. Heat Index Chart**

Temperature (F) versus Relative Humidity (%)									
°F	90%	80%	70%	60%	50%	40%	30%	20%	10%
65	65.6	64.7	63.8	62.8	61.9	60.9	60.	59.1	58.1
70	71.6	70.7	69.8	68.8	67.9	66.9	66.	65.1	64.1
75	79.7	76.7	75.8	74.8	73.9	72.9	72.	71.1	70.1
80	88.2	85.9	84.2	82.8	81.6	80.4	79.	77.4	76.1
85	101.4	97.	93.3	90.3	87.7	85.5	83.5	81.6	79.6
90	119.3	112	105.8	100.5	96.1	92.3	89.2	86.5	84.2
95	141.8	131.1	121.7	113.6	106.7	100.9	96.1	92.2	89.2
100	168.7	154.	140.9	129.5	119.6	111.2	104.2	98.7	94.4
105	200	180.7	163.4	148.1	134.7	123.2	113.6	105.8	100.
110	235.	211.2	189.1	169.4	151.9	136.8	124.1	113.7	105.8
115	275.3	245.4	218	193.3	171.3	152.1	135.8	122.3	111.9
120	319.1	283.1	250.	219.9	192.9	169.1	148.7	131.6	118.2

Risk Level	Possible Heat Disorder:
Caution	Fatigue possible with prolonged exposure and physical activity.
Extreme Caution	Sunstroke, heat cramps and heat exhaustion possible.
Danger	Sunstroke, heat cramps, and heat exhaustion likely, and heat stroke possible.
Extreme Danger	Heat stroke highly likely with continued exposure.

\*Note: On the HI chart, the shaded zone above 105 °F corresponds to a level that may cause increasingly severe heat disorders with continued exposure or physical activity.

### **3.1.9 Mass Transportation Accidents**

For the purpose of this study, mass transportation is defined as the means, or system, that transfers large groups of individuals from one place to another. This section addresses only transportation accidents involving people, not materials. Thus, mass transportation accidents include public airlines, railroad passenger cars, metro rail travel, tour buses, city bus lines, school buses, riverboat casinos, and other means of public transportation.

The State of Missouri serves as a transportation crossroad for the United States. Missouri, being centrally located in the nation, is a natural hub for many major airlines and other types of tourist and business travel. Many cross-country travelers use Missouri terminals to connect with transport changes. Our airways, railways, and highways are used as nonstop thoroughfares as well.

In 1993, Missouri's largest city, St. Louis, began operating a MetroLink rail transportation system. Before service began, ridership was projected at 12,000 per day. In August 1993, during the system's first month of operation, between 20,000 and 35,000 rode the MetroLink each day. In July 1994, the average weekday ridership topped 42,000 commuters. MetroLink carried nearly 9 million customers during its first year of operation. During 1997 and 1998, 54.2 million residents rode public transportation, with MetroLink ridership continuing to grow, averaging 44,500 per day. During Independence Day celebrations on July 4, 1999, the MetroLink moved 160,833 passengers. Normally, the largest numbers of people are transported during the morning and evening rush hours.

Amtrak, the state's major passenger rail carrier, uses tracks that cross the entire state, from east to west. Although Amtrak has experienced a decline in passengers during this decade, it continues to carry a large number of passengers daily. The peak periods are related to holidays or special events.

Branson, Missouri, which is located close to the state's southwestern border, has become one of this state's major tourist attractions. It ranks high among the nation's top attractions. Because Branson is a small community, tourists are more visible there than in Kansas City and St. Louis. The city has been expanding its services (number of hospital beds, fire equipment, ambulances) and is able to provide more assistance than other small communities in the state.

Tour bus travel in the state is on the increase. With Branson continuing to expand, more bus traffic can be expected. The Passenger Carrier Inspection Division (Division) of MoDOT has developed a comprehensive passenger carrier safety inspection program. Passenger carrier safety is a primary concern for the Division because Missouri, and especially Branson, is among the top tourist destinations in North America. Division inspectors conduct safety inspections at destinations or carrier terminals when buses do not have passengers on board.

The Division has two classifications of passenger carriers: for-hire and private. For-hire passenger carriers provide service to the general public and are required to register with the Division. Private carriers provide passenger service in furtherance of a commercial enterprise. Examples include, but are not limited to, hotel courtesy buses, airport passenger shuttle services, buses operated by professional musicians, and buses for civic and other groups such as scout groups where no fees are collected.

The definition of a passenger carrier varies somewhat depending on whether the operation is entirely intrastate or interstate. The Federal Highway Administration's Office of Motor Carriers defines interstate passenger carrier as any vehicle designed to transport more than eight passengers, including the driver, across state boundaries. The Administration's definition includes any vehicle (not operated as a taxi or otherwise exempt) designed to transport more than six passengers, including the driver, within the state.

### 3.1.10 Nuclear Power Plants

There are presently four fixed nuclear facilities or reactors that under extreme circumstances and conditions could pose a threat to citizens of Missouri. These four reactors fall into two categories: research reactors and commercial nuclear power reactors. The first category, research reactors, represents a hazard only to personnel or others on site at the facility. Therefore, these reactors are not included in state radiological plans involving off-site emergency preparedness. For the second category, commercial nuclear power reactors, a worst-case scenario involving a significant release of radioactive material could force the evacuation of the general population within a 10-mile radius of the facility. A release of this magnitude could also contaminate food sources within a 50-mile radius.

The magnitudes of releases from nuclear plant sites vary depending on the nature of the accident type, reactor design, and meteorological conditions during the release. The Nuclear Regulatory Commission (NRC) and FEMA have developed regulatory guidance that both the state and utility must meet to protect the health and safety of the general population within the 10-mile Emergency Planning Zone (EPZ). Four classes of Emergency Action Levels are used for early notification of incidents, with clear instructions for emergency organizations within the EPZ.

The four emergency classifications listed in progression of severity are notification of unusual event, alert, site area emergency, and general emergency. These levels are discussed below.

1. **Notification of Unusual Event** – This classification describes unusual events that are in process or have occurred and indicates a potential degradation of the safety level of the plant. No releases of radioactive material requiring off-site response or monitoring are expected unless safety systems are further degraded.
2. **Alert** – This classification describes unusual events that are in process or have occurred and indicate a potential degradation of the level of plant safety. Any releases are expected to be limited to small fractions of the Environmental Protection Agency (EPA) Protective Action Guideline (PAG) exposure levels.
3. **Site Area Emergency** – This classification level describes events in process or having occurred that involve actual or likely major failures of the plant functions needed to protect the public. No releases are expected to exceed EPA PAG exposure levels except near the site boundary.
4. **General Emergency** – This classification describes an event in process or having occurred that involves actual or imminent substantial core degradation or melting, with the potential for loss of containment integrity. Releases can reasonably be expected to exceed the EPA PAG exposure levels off-site for more than the immediate site area.

### **3.1.11 Public Health Emergencies/Environmental Issues**

Public health emergencies can take many forms—disease epidemics, large-scale incidents of food or water contamination, or extended periods without adequate water and sewer services. There can also be harmful exposure to chemical, radiological, or biological agents, and large-scale infestations of disease-carrying insects or rodents. The first part of this section focuses on emerging public health concerns and potential pandemics, while the second part addresses air and water pollution caused by natural or man-induced means.

Public health emergencies can occur as primary events by themselves, or they may be secondary to another disaster or emergency, such as tornado, flood, or hazardous material incident. For more information on those particular incidents, see Section 3.1.16 (Tornados/Severe Thunderstorms), Section 3.1.12 (Riverine Flooding), and Section 3.1.7 (Hazardous Materials). The common characteristic of most public health emergencies is that they adversely impact, or have the potential to adversely impact, a large number of people. Public health emergencies can be statewide, regional, or localized in scope and magnitude.

In particular, two public health hazards have recently emerged as issues of great concern, with far reaching consequences. One pertains to the intentional release of a radiological, chemical, or biological agent, as a terrorist act of sabotage to adversely impact a large number of people. For more information on biochemical terrorism (including discussions on potential pandemics and other public health emergencies), see the Annex N of this document. The second hazard concerns a deadly outbreak (other than one caused by an act of terrorism) that could kill or sicken thousands of people across the county or around the globe, as in the case of the Spanish Flu epidemic of 1918-1919.

Whether natural or man-induced, health officials say the threat of a dangerous new strain of influenza virus in pandemic proportions is a very real possibility in the years ahead. Unlike most illnesses, the flu is especially dangerous because it is spread through the air. A classic definition of influenza is a respiratory infection with fever. Each year, flu infects humans and spreads around the globe. There are three types of influenza virus, known as Types A, B, and C. Type A is the most common, most severe, and the primary cause of flu epidemics. Type B cases occur sporadically and sometimes as regional or widespread epidemics. Type C cases are quite rare and hence sporadic, but localized outbreaks have occurred. Fortunately, influenza usually is treatable, and the mortality rate remains low. Each year, scientists estimate which particular strain of flu is likely to spread, and they create a vaccine to combat it. A flu pandemic occurs when the virus suddenly changes or undergoes an “antigenic shift,” permitting it to attach to a person’s respiratory system and leave the body’s immune system defenseless against the invader.

Environmental concerns addressed in this section focus on air and water pollution, because contamination of those media can have widespread impacts on public health, with devastating consequences. Particular issues of primary concern associated with sources of air and water pollution change over time depending on recent industrial activity, economic development, enforcement of environmental regulations, new scientific information on adverse health affects of particular contaminants or concentrations, and other factors. Those issues are detailed in Section 3.2.11.

### **3.1.12 Riverine Flooding (Major and Flash)**

Floods are the number one weather-related killer in the United States. Between 1990 and 2002, Missouri recorded more than 81 deaths attributed to flooding. A flood is partial or complete inundation of normally dry land areas. Riverine flooding is defined as the overflow of rivers, streams, drains, and lakes due to excessive rainfall, rapid snowmelt, or ice. There are several types of riverine floods, including headwater, backwater, interior drainage, and flash flooding. Flash flooding is characterized by rapid accumulation or runoff of surface waters from any source. This type of flooding impacts smaller rivers, creeks, and streams and can occur as a result of dams being breached or overtopped. Because flash floods can develop in a matter of hours, most flood-related deaths result from this type of event.

The areas adjacent to rivers and stream banks that carry excess floodwater during rapid runoff are called floodplains. A floodplain is defined as the lowland and relatively flat area adjoining a river or stream. The terms “base flood” and “100-year flood” refer to the area in the floodplain that is subject to a one percent or greater chance of flooding in any given year, based on historical records. Floodplains are a vital part of a larger entity called a basin, which is defined as all the land drained by a river and its branches.

The land that forms the State of Missouri is contained within the Mississippi, Missouri, Arkansas, and White River Basins. The Mississippi River Basin drains the eastern part of the state, the Missouri River Basin drains most of the northern and central part of the state, the White River Basin drains the south-central part of the state, and the Arkansas River Basin drains the southwest part of the state. The Missouri River Basin drains over half the state. When the Missouri River joins the Mississippi River at St. Louis, it becomes part of the Mississippi River Basin, which is the largest basin, in terms of volume of water drained, on the North American continent.

In some cases, flooding may not be directly attributable to a river, stream, or lake overflowing its banks. Rather, it may simply be the combination of excessive rainfall or snowmelt, saturated ground, and inadequate drainage. With no place to go, the water will find the lowest elevations—areas that are often not in a floodplain. This type of flooding, often referred to as sheet flooding, is becoming increasingly prevalent as development outstrips the ability of the drainage infrastructure to properly carry and disburse the water flow. Flooding also occurs due to combined storm and sanitary sewers that cannot handle the tremendous flow of water that often accompanies storm events. Typically, the result is water backing into basements, which damages mechanical systems and can create serious public health and safety concerns.



### 3.1.13 Severe Winter Weather (Snow, Ice and Extreme Cold)

Severe winter weather, including snowstorms, ice storms, and extreme cold, can affect any area of Missouri. The greatest threat is likely to occur in the area north of the Missouri River, as with the devastating Kansas City area ice storm on January 31, 2002, which stretched into central Missouri and led to a presidential disaster declaration. Severe weather, such as snow, ice storms, and extreme cold can cause injuries, deaths, and property damage in a variety of ways. Winter storms are considered deceptive killers. This is because most deaths are indirectly related to the storm. Causes of death range from traffic accidents due to adverse driving conditions such as icy roads, to heart attacks caused by overexertion while shoveling snow and from other related activities. Hypothermia or frostbite may be considered the most direct cause of death and injury that can be attributed to winter storms or severe cold.

**Hypothermia** (low body temperature) can occur during longer periods of exposure when the body temperature drops below 95°F. A person will become disoriented, confused, and shiver uncontrollably, eventually leading to drowsiness and apparent exhaustion. In severe cases, death is possible.

**Frostbite** occurs when the skin becomes cold enough to actually freeze. A loss of feeling and a white or pale appearance in the extremities, such as fingers, toes, ear lobes, or the nose are symptoms of frostbite.

Economic costs are also difficult to measure. Heavy accumulations of ice can bring down trees, electric power lines and poles, telephone lines, and communications towers. Such power outages create an increased risk of fire, as home occupants use alternative fuel sources (wood, kerosene, etc. for heat, and fuel-burning lanterns or candles for emergency lighting). These storms can also affect utility and city operations due to debris removal and landfill hauling. In the 2002 ice storm, one home burned when ice-laden tree limbs fell and tore the electrical junction box from the outside of the home. Electrical sparks ignited a blaze that destroyed the home. Crops and trees can be damaged, and livestock can be killed or injured due to deep snow, ice, or severe cold. Buildings and automobiles may be damaged from falling tree limbs, power lines, and poles. Local governments, home and business owners, and power companies were faced with spending millions of dollars to restore services, remove debris, and haul debris. Federal public assistance for local governments and individual assistance for citizens and businesses under Presidential Disaster Declaration MO-DR 1403 helped cover much of the expense (see Section 3.2.13, Synopsis).

The types of watches and warnings during severe winter weather are listed below:

1. **Winter Weather Advisory** – Winter weather conditions are expected to cause significant inconveniences and may be hazardous. If caution is exercised, these situations should not become life threatening. Often, the greatest hazard is to motorists.
2. **Winter Storm Watch** – Severe winter conditions, such as heavy snow and/or ice are possible within the next day or two.
3. **Winter Storm Warning** – Severe winter conditions have begun or are about to begin.
4. **Blizzard Warning** – Snow and strong winds will combine to produce a blinding snow (near-zero visibility), deep drifts, and life-threatening wind chill.

### **3.1.14 Special Events**

Significant events or “designated special events” may include any type of event where large groups of people are gathered together, regardless of the cause or purpose of the event, where expanded security and other resources are required above and beyond the resources typically available to local and/or state government. In such instances, event sponsors, in conjunction with local and state authorities are responsible for coordinating the event and requesting assistance at the federal level, if necessary.

Special events may be motivated by political, economic or social causes, as in the case of Inaugural Ceremonies, State of the Union Addresses, and Summit Conferences, or by recreational causes, as with the Olympics and other major sporting events (e.g., Super Bowl, World Series, etc.). Special events may also include large holiday events such as the annual Fair St. Louis 4<sup>th</sup> of July Celebration, where large numbers of people crowd onto the Mississippi Riverfront in St. Louis.

The perception of inherent dangers and threats facing this country and the State of Missouri has changed significantly since the terrorist attacks of September 11, 2001. In keeping with the new framework of the developing “Initial Plan Draft” of the National Response Plan (NRP), the Missouri State Emergency Operations Plan (SEOP) should also provide a Hazard Analysis consideration section for special events as described herein. See the Historical Statistics in Section 3.2.14 for details about some of the potential impacts on security and medical resources that a “special event” could pose for consideration.

Anytime a large number of people are congregated in one area, an incident resulting from just about any of the hazards detailed in this Missouri hazard analysis could have devastating impacts. For example, consider the impact a sudden, severe hailstorm could have on the population visiting the aforementioned Fair St. Louis, which well over one million people usually attend each year. A hailstorm such as this struck the north St. Louis County area in April of 2001, causing thousands of dollars of damage to residences and vehicles. This storm produced baseball-size (and larger) hailstones, which killed many pets and nearly all the waterfowl residing at local park ponds. An incident such as this could have devastating impacts if it were to suddenly strike the fairgrounds with over 250,000 people in attendance and without shelter (not to mention the potential impact a terrorist attack incident could impose at such an event). Medical services would likely be overwhelmed with the number of injuries.

### **3.1.15 Terrorism**

Terrorism, as defined by the Federal Bureau of Investigation (FBI), is “the unlawful use of force or violence against persons or property to intimidate or coerce a government, the civilian population, or any segment thereof, in furtherance of political or social objectives.” The effects of terrorism can vary significantly, including loss of life, injuries to people and properties, and disruptions in services (e.g., water supplies, public transportation, communications).

According to the FBI, there are two primary types of terrorism:

1. **Domestic Terrorism** – involves groups or individuals whose terrorist activities are directed at elements of our government or populations without foreign direction.
2. **International Terrorism** – involves terrorist activity committed by groups or individuals who are foreign-based and/or directed by countries or groups outside the United States or whose activities transcend national boundaries.

### **Forms of Terrorism**

Terrorism can take place in various forms, depending on the technological means available to the terrorist group, the nature of the issue motivating the attack, and the points of weakness of their target. Potential terrorist actions include:

- **Bombings** – Bombings have long been used in terrorist attacks, and probably represent the most “traditional” form of terrorism. These types of incidents range from small-scale letter bombs to large-scale attacks on specific buildings. Other bomb-related incidents frequently involve “suicide bombers,” who sacrifice themselves for their cause.
- **Airline Attacks** – In the past, terrorist acts involving aircrafts were generally restricted to hijackings and bombings. However, the attacks on the World Trade Center buildings in New York City in 2001 brought a new avenue to light – the use of commercial aircrafts to attack infrastructure targets. Surface-to-air missile attacks also present a threat to U.S. aircrafts.
- **Weapons of Mass Destruction (WMD) Attacks** – WMD attacks usually involve nuclear weapons or biological or chemical agents. Chemical and biological agents are infectious microbes or toxins used to produce illness or death. They can be dispersed as aerosols or airborne particles directly onto a population, producing an immediate effect (a few seconds to a few minutes) or a delayed effect (several hours to several days). Severity of injuries depends on the type and amount of the agent used and duration of exposure. Because some biological agents take time to grow and cause disease, an attack using this type of agent may go unnoticed for several days.
- **Infrastructure Attacks** – These types of attacks can impact various potential targets, including water distribution systems and treatment plants, utility companies and services, emergency services, gas and oil production facilities, telecommunications centers, transportation terminals, media facilities, government buildings, and religious institutions.
- **Cyberterrorism** – Cyberterrorism pertains to attacks on computer-based systems that are designed to spread disinformation and propaganda, deny service to legitimate computer users, spread electronic viruses to corrupt vital data, or cause critical infrastructure outages. Political conflicts that have led to attacks on cyber systems include clashes between India and Pakistan, Israel and the Palestinians, the North Atlantic Treaty Organization (NATO), and Serbia in Kosovo.
- **Agroterrorism** – Agroterrorism involves intentional contamination of commercial produce or meat supplies. Because the U.S. supplies approximately 16 percent of the world’s meat, 40 percent of its soybeans, and 41 percent of its corn, a deadly fungus or bacteria could be devastating. Of the 222 possible bioterrorism attacks that have

occurred worldwide in the 20<sup>th</sup> century, only 17 of those targeted commercial livestock or plants, according to the Institute for National Strategic Studies.

- **Arson** – Intentional fires have caused extensive damage during terrorist-related incidents in the past. These types of incidents may also be associated with bombings and usually target specific structures, such as churches. Although deliberately set fires have been reported at 15 churches in Missouri, none have been determined to be hate crime-related or terrorist-related incidents.
- **Kidnappings/Assassinations** – Kidnappings and assassinations may also be terrorist-related incidents, but because these events generally involve few individuals, their effect on emergency management operations may be minimal in terms of response.

### **Domestic Terrorism**

According to the FBI, domestic terrorist groups represent interests that span the full spectrum of political and economic viewpoints, as well as social issues and concerns. The current domestic terrorist threat primarily comes from right-wing extremist groups, left-wing and Puerto Rican extremist groups, and special interest extremists, which are discussed below:

- **Right-Wing Terrorism** – Right-wing terrorist groups often adhere to the principles of racial supremacy and embrace anti-government, anti-regulatory beliefs. Generally, extremist right-wing groups engage in activities that are protected by constitutional guarantees of free speech and assembly. Examples of this type of group include Aryan Nations, the Order, and Posse Comitatus. Missouri has seen some activity from these groups in the past few years. According to the Southern Poverty Law Center, Missouri has 27 extremist groups operating within its borders. Although a state statute against paramilitary training exists, one of these groups is also known to have such a facility in Missouri. In addition, several special gatherings of extremist groups have taken place within the state in recent years.
- **Left-Wing Terrorism** – This category of terrorism includes groups that generally profess a revolutionary socialist doctrine and view themselves as protectors of the people against the “dehumanizing effects” of capitalism and imperialism. Examples of this type of terrorist group include the Armed Forces of National Liberation and the Macheteros (both from Puerto Rico), the African National Ujammu, the AnSaru Allah Community, the Dar-UI Movement, and the United Freedom Front.
- **Special Interest Terrorism** – Special interest terrorism differs from traditional right-wing and left-wing terrorism in that extremist special interest groups seek to resolve specific issues, rather than effect more widespread political change. Examples include the Animal Liberation Front, Up the IRS, and the Earth Night Action Group. The FBI is also investigating anti-abortion groups. If the FBI is able to prove that a national conspiracy exists among these perpetrators, they could be prosecuted under domestic terrorism laws.

### **International Terrorism**

The United States continues to face a formidable challenge from international terrorism. In general terms, the international terrorist threat can be divided into three categories: loosely affiliated extremists operating under the radical jihad movement, formal terrorist organizations,

and state sponsors of terrorism. Each of these categories, which represent threats to U.S. citizens and interests both abroad and at home, are described as follows:

- **Loosely Affiliated Extremists** – These are motivated by political or religious beliefs, posing the most urgent threat to the United States.
- **Formal Terrorist Organizations** – These organizations are typically autonomous and have their own infrastructures, personnel, financial arrangements, and training facilities.
- **State Sponsors of Terrorism** – This category is comprised of countries known to sponsor terrorism and to view it as a tool of foreign policy. Currently, the U.S. Department of State recognizes seven countries in this category: Iran, Iraq, Sudan, Libya, Syria, Cuba, and North Korea.

**Table 2** summarizes foreign terrorist organizations designated by the U.S. Secretary of State. Other international terrorist groups documented as being active in 2000 are listed in **Table 3**.

**Table 2. Foreign Terrorist Organizations\***

Group Name	Location/Area of Operation
Abu Nidal Organization (ANO)	Iraq, Lebanon, Libya, Egypt
Abu Sayyaf Group (ASG)	Philippines, Malaysia
Armed Islamic Group (GIA)	Algeria
Akum Supreme Truth (Aum)	Japan, Russia
Basque Fatherland and Liberty (ETA)	Spain, France
Al-Gama'a al-Islamiyya (Islamic Group IG)	Egypt, Sudan, United Kingdom, Afghanistan, Austria, Yemen
HAMAS (Islamic Resistance Movement)	Israel
Harakat ul-Mujahidin (HUM)	Pakistan, Afghanistan
Hizballah (Party of God)	Lebanon; also cells in Europe, South America, North America, and Asia
Islamic Movement of Uzbekistan (IMU)	Afghanistan, Tajikistan, Uzbekistan, Kyrgyzstan
Japanese Red Army (JRA)	Unknown; possibly Asia or Lebanon
Al-Jihad	Egypt, Afghanistan, Pakistan, Sudan, Lebanon, United Kingdom
Kach and Kahane Chai	Israel, West Bank settlements
Kurdistan Workers' Party (PKK)	Turkey, Europe, Middle East
Liberation Tigers of Tamil Eelam (LTTE)	Sri Lanka
Mujahedin-e Khalq Organization (MEK or MKO)	Iran, Iraq
National Liberation Army (ELN)-Columbia	Columbia, Venezuela
The Palestine Islamic Jihad (PIJ)	Israel, Jordan, Lebanon, Syria
Palestine Liberation Front (PLF)	Iraq
Popular Front for the Liberation of Palestine (PFLP)	Syria, Lebanon, Israel
Popular Front for the Liberation of Palestine-General Command (PFLP-GC)	Damascus, Lebanon
Al-Quaida	Afghanistan
Revolutionary Armed Forces of Columbia (FARC)	Columbia, Venezuela, Panama, Ecuador
Revolutionary Organization 17 November (17 November)	Unknown

Group Name	Location/Area of Operation
Revolutionary People's Liberation Party/Front (DHKP/C)	Turkey
Revolutionary People's Struggle (ELA)	Greece
Sendero Luminoso (Shining Path, or SL)	Peru
Tupac Amaru Revolutionary Movement (MRTA)	Peru

\* Designated by the U.S. Secretary of State, pursuant to Section 219 of the Immigration and Nationality Act, as amended by the Antiterrorism and Effective Death Penalty Act of 1996.

**Table 3. Other Terrorist Groups (Active In 2000)**

Group Name	Location/Area of Operation
Alex Boncayao Brigade (ABB)	Philippines
Army for the Liberation of Rwanda (ALIR)	Congo, Rwanda, Burundi
Continuity Irish Republican Army (CIRA)	Northern Ireland, Irish Republic
First of October Abtifascist Resistance Group (GRAPO)	Spain
Irish Republican Army (IRA)	Northern Ireland, Irish Republic, Great Britain, Europe
Jaish-e-Mohammed (JEM) (Army of Mohammed)	Pakistan, Afghanistan
Lashkar-e-Tayyiba (LT) (Army of the Righteous)	Pakistan, Afghanistan
Loyalist Volunteer Force (LVF)	Northern Ireland, Ireland
New People's Army (NPA)	Philippines
Orange Volunteers (OV)	Northern Ireland
People Against Gangsterism and Drugs (PAGAD)	South Africa
Real IRA (RIRA)	Northern Ireland, Irish Republic, Great Britain
Red Hand Defenders (RHD)	Northern Ireland
Revolutionary United Front (RUF)	Sierra Leone, Liberia, Guinea
United Self-Defense Forces/Group of Columbia (AUC-Autodefensas Unidas de Columbia)	Columbia

### Government Authority

After the attacks on September 11, 2001, parts of 22 domestic agencies were consolidated into one department, the Department of Homeland Security (DHS), to protect the nation against future terrorist threats. Roles of those agencies include analyzing threats and intelligence, guarding national borders and airports, protecting critical infrastructure, and coordinating response efforts for future emergencies. Many feel the creation of DHS is the most significant transformation of the U.S. government in the last 50 years. The agencies that comprise DHS are segregated into four major categories: Border and Transportation Security, Emergency Preparedness and Response, Science and Technology, and Information Analysis Infrastructure Protection. Those agencies that comprise DHS are listed in **Table 4**. In addition to the agencies listed in the table, the Secret Service and the Coast Guard are also included in the Department of Homeland Security, reporting directly to the Secretary.

**Table 4. DHS Organization**

<b>BORDER AND TRANSPORTATION SECURITY</b>
U.S. Customs Service Immigration and Naturalization Service Federal Protective Service Transportation Security Administration Federal Law Enforcement Training Center Animal and Plant Health Inspection Service
<b>EMERGENCY PREPAREDNESS AND RESPONSE</b>
Federal Emergency Management Agency Strategic National Stockpile and the National Disaster Medical System Nuclear Incident Response Team Domestic Emergency Support Teams National Domestic Preparedness Office
<b>SCIENCE AND TECHNOLOGY</b>
CBRN Countermeasures Programs Environmental Measurements Laboratory National BW Defense Analysis Center Plum Island Animal Disease Center
<b>INFORMATION ANALYSIS AND INFRASTRUCTURE PROTECTION</b>
Critical Infrastructure Assurance Office Federal Computer Incident Response Center National Communications System National Infrastructure Protection Center Energy Security and Assurance Program

The FBI is the lead federal agency for investigating terrorism. The FBI is authorized to open an investigation whenever “facts or circumstances reasonably indicate that two or more persons are engaged in an enterprise for the purpose of furthering political or social goals wholly or in part through activities that involve force or violence and a violation of the criminal laws of the United States.” In any given year, the FBI engages in approximately 24 full-scale domestic terrorism investigations. The FBI maintains a state-of-the-art computer database known as the Terrorist Information System, which contains information on known or suspected terrorist groups and individuals. The system contains information on over 200,000 individuals and over 3,000 organizations. The FBI is also implementing a new management and operational initiative to further strengthen its ability to combat terrorism. This initiative, referred to as MAXCAP05, is designed to bolster its Counter-Terrorism Program by fiscal year 2005.

After terrorist-related events, communities may receive assistance from state and federal agencies operating within the existing Integrated Emergency Management System. FEMA is the lead federal agency for supporting state and local response to the consequences of terrorist attacks.

### **3.1.16 Tornadoes and Severe Thunderstorms**

Tornadoes are cyclical windstorms often associated with the Midwestern areas of the United States. Weather conditions conducive to tornadoes often produce a wide range of other dangerous storm activities, including severe thunderstorms, downbursts, straight-line winds, lightning, hail, and heavy rains. For the purpose of this analysis, tornadoes are considered in one

category. Other severe weather activities, noted above, are referenced separately in the Synopsis of Section 3.2.16.

Essentially, tornadoes are a vortex storm with two components of winds. The first is the rotational winds that can measure up to 500 miles an hour, and the second is an uplifting current of great strength. The dynamic strength of both these currents can cause vacuums that can overpressure structures from the inside. Although tornadoes have been documented in all 50 states, most of them occur in the central United States. The unique geography of the central United States allows for the development of thunderstorms that spawn tornadoes. The jet stream, which is a high-velocity stream of air, determines which area of the central United States will be prone to tornado development. The jet stream normally separates the cold air of the north from the warm air of the south. During the winter, the jet stream flows west to east from Texas to the Carolina coast. As the sun "moves" north, so does the jet stream, which at summer solstice flows from Canada across Lake Superior to Maine. During its move northward in the spring and its recession south during the fall, the jet stream crosses Missouri, causing the large thunderstorms that breed tornadoes.

Tornadoes spawn from the largest thunderstorms. The associated cumulonimbus clouds can reach heights of up to 55,000 feet above ground level, and are commonly formed when gulf air is warmed by solar heating. The moist, warm air is overridden by the dry cool air provided by the jet stream. This cold air presses down on the warm air, preventing it from rising, but only temporarily. Soon, the warm air forces its way through the cool air, and the cool air moves downward past the rising warm air. This air movement, along with the deflection of the earth's surface, can cause the air masses to start rotating. This rotational movement around the location of the breakthrough forms a vortex, or funnel. If the newly created funnel stays in the sky, it is referred to as a funnel cloud. However, if it touches the ground, the funnel officially becomes a tornado.

A typical tornado can be described as a funnel-shaped cloud that is "anchored" to a cloud, usually a cumulonimbus, which is also in contact with the earth's surface. This contact on average lasts 30 minutes and covers an average distance of 15 miles. The width of the tornado (and its path of destruction) is usually about 300 yards. However, tornadoes can stay on the ground for upward of 300 miles and can be up to a mile wide. NWS, in reviewing tornadoes occurring in Missouri between 1950 and 1996, calculated the mean path length at 2.27 miles and the mean path area at 0.14 square mile. The average forward speed of a tornado is 30 miles per hour but may vary from nearly stationary to 70 miles per hour. The average tornado moves from southwest to northeast, but tornados have been known to move in any direction. Tornadoes are most likely to occur in the afternoon and evening, but have been known to occur at any hour of the day or night.

Tornadoes are classified according to the F- Scale (developed by Dr. Theodore Fujita, a renowned severe storm researcher). The F- Scale attempts to rank tornadoes according to wind speed based on the damage caused (**Table 5**). **Table 6** lists Missouri Tornadoes by F-Scale that occurred between 1950-1996.



**Table 5. Fujita Tornado Damage Scale**

Scale	Wind Speed*(MPH)	Typical Damage
<b>F0</b>	<73	Light damage: Some damage to chimneys; branches broken off trees; shallow-rooted trees pushed over; signboards damaged.
<b>F1</b>	73-112	Moderate damage: Surface peeled off roofs; mobile homes pushed off foundations or overturned; moving autos blown off roads.
<b>F2</b>	113-157	Considerable damage: Roofs torn off frame houses; mobile homes demolished; boxcars overturned; large trees snapped or uprooted; light-object missiles generated; cars lifted off ground.
<b>F3</b>	158-206	Severe damage: Roofs and some walls torn off well-constructed houses; trains overturned; most trees in forests uprooted; heavy cars lifted off the ground and thrown some distance.
<b>F4</b>	207-260	Devastating damage: Well-constructed houses leveled; structures with weak foundations blown away some distance; cars thrown, and large missiles generated.
<b>F5</b>	261-318	Incredible damage: Strong frame houses leveled off foundations and swept away; automobile-sized missiles propelled through the air more than 100 meters (109 yards); trees debarked; incredible phenomena will occur.

Developed in 1971 by T. Theodore Fujita of the University of Chicago.

\*Do not use F-scale wind speeds literally. These wind speed numbers are actually estimates and have never been scientifically verified. Different wind speeds may cause similar damage from place to place – even from building to building. Without a thorough engineering analysis of tornado damage in any event, the actual wind speeds needed to cause that damage are unknown. (The National Weather Service, 2003)

**Table 6. Missouri Tornadoes By F-Scale, 1950-1996**

Scale	Percentage
F0	47
F1	24
F2	16
F3	12
F4	1
F5	0

### 3.1.17 Utilities

Utility interruptions and failures may involve electrical power, natural gas, public water and communications systems. These systems or a combination of these systems exist throughout the state, and are subject to damage from digging, fire, traffic accidents, and severe weather, including flooding and other day-to-day events. Many utilities are localized and serve only one community, while others are dispersed over a wide or regional area with many facilities located throughout the service area. For example, many electric companies have multiple generating facilities, which can redistribute power via transmission lines connected to load stations. Therefore, power can be redistributed if needed, so that power is lost to only a limited area. Many water companies have some type of back-up systems, such as water impoundments, other deep wells or hook-up arrangements with other water companies. Similar switching and rerouting capabilities may exist with communications and natural gas utilities. Many utilities utilize emergency batteries or generators to provide back-up power for high priority equipment.

## 3.2 Profiling Hazard Events

**44 CFR 201.4(c)(2)(i) – The risk assessment shall include an overview of the location of all natural hazards that can effect the State, including information on previous occurrences of hazard events, as well as the probability of future hazard events, using maps where appropriate.**

A careful examination of hazard event profiles relevant to the Missouri study area serves to define historic hazard trends and provides a reference point for understanding the potential impacts from future predicted events. Reviewing historic data assists in evaluating hazard event profiles, which focus on answering the following questions: *How often might a particular disaster occur? Where are we most likely to be affected? and, How bad can it get?*

The hazards presented here are those that have been experienced by or pose a potential threat to Missourians. However, local or isolated problems that constitute potential disasters should not be overlooked.

**Attack (Nuclear, Conventional, Chemical, and Biological)**  
**Civil Disorder**  
**Dam Failure**  
**Drought**  
**Earthquake**  
**Fires (Structural, Urban and Wild)**  
**Hazardous Materials Release (fixed site and transportation accidents)**  
**Heat Wave**  
**Mass Transportation Accidents**  
**Nuclear Power Plants**  
**Public Health Emergencies/Environmental Issues**  
**Riverine Flooding (Major and Flash)**  
**Severe Winter Weather**  
**Special Events**  
**Terrorism**  
**Tornados and Severe Thunderstorms**  
**Utilities**

These hazards were rated to prioritize which ones pose the greatest risk to the State of Missouri.

The following definitions explain the ratings for each hazard:

**Probability:** The likelihood that the hazard will occur.

**Low**                      The hazard has little or no chance of happening.

**Moderate**              The hazard has a reasonable probability of occurring.

**High**                      The probability is considered sufficiently high to assume that the event will occur.

**Severity:** The deaths, injuries, or damages (property or environmental) that could result from the hazard.

**Low** Few or minor damages or injuries are likely.

**Moderate** Injuries to personnel and damages to property and the environment is expected.

**High** Deaths and major injuries and damages will likely occur.

The hazards covered in the analysis are listed below, along with the overall rating they were given by the State Hazard Mitigation Project Coordinating Group. The ratings presented in **Table 7** below are situational dependent.

**Table 7. Hazard Probability and Severity**

Hazard	Probability	Severity
Attack (Nuclear, Conventional, Chemical and Biological)	Low	Low to High
Civil Disorder	Low	High
Dam Failure	Low	Moderate
Drought	Moderate	Moderate
Earthquake	High	High
Fires: Structural & Urban Wild	High Moderate	Moderate Low to Moderate
Hazardous Materials Release: Fixed facility accidents Transportation accidents	Moderate High	Moderate Moderate
Heat Wave	Moderate	Moderate
Mass Transportation Accidents	Moderate	Moderate
Nuclear Power Plants (Emergencies and Accidents)	Moderate	Moderate
Public Health Emergencies/Environmental Issues	High	Moderate to High
Riverine Flooding (Major and Flash)	High	High
Severe Winter Weather/Snow/Ice/Severe Cold: North of MO River South of MO River	High Low	Moderate Moderate
Special Events	Low	High
Terrorism	Low	Low to High
Tornadoes/Severe Thunderstorms	High	High
Utilities (Interruptions and System Failures)	High	Low

Based on the ratings selected for each of the hazards, the hazards with both high probability and severity were prioritized for additional analysis. Thus earthquakes, tornadoes and riverine flooding were studied further using the risk assessment methodology (see section 3.3). Public Health Emergencies/Environmental Issues have high probability and potentially high severity as well, but estimated damage and loss are more difficult to quantify as they may occur as a primary hazard or secondary hazard (i.e., as a result of a flood). Also, the location of impact is very broad in comparison to other more typical locations such as proximity to earthquake fault lines,

tornado corridors or floodplains. Therefore, detailed historical information and potential impacts are covered in this risk assessment study.

In the U.S., 95 percent of all presidential disaster declarations have been related to weather or flood events. In Missouri, 100 percent of the presidential disaster declarations since 1975 have also been related to weather or flood events. **Table 8** summarizes presidential disaster declarations in Missouri since 1975.

**Table 8. Presidential Disaster Declarations for Missouri Since 1975**

Declaration Date	Incident Type	No. Of Counties Designated	Type of Assistance By County*		
			IA	PA	IA & PA
May 3, 1975	Tornadoes, High Winds, Hail	4			4
July 21, 1976	Severe Storms, Flooding	4			4
September 24, 1976	Drought	94		94	
May 7, 1977	Tornadoes, Flooding	7			7
September 14, 1977	Severe Storms, Flooding	6			6
March 12, 1979	Ice Jam, Flooding	2		2	
April 21, 1979	Tornadoes, Torrential Rains, Flooding	17	1		16
May 15, 1980	Severe Storms, Tornadoes	1	1		
August 26, 1982	Severe Storms, Flooding	3	1		2
December 10, 1982	Severe Storms, Flooding	17	18	1	5
June 21, 1984	Severe Storms, Flooding	11	1	8	2
October 14, 1986	Severe Storms, Flooding	30	7	15	8
May 24, 1990	Severe Storms, Flooding	10	2		8
May 11, 1993	Severe Storms, Flooding	8	8		
July 9, 1993	Severe Storms, Flooding	102	14		88
					Cities: 3
December 1, 1993	Severe Storms, Tornadoes, Flooding	24	10		14
April 21, 1994	Severe Storms, Tornadoes, Flooding	18	18		
June 2, 1995	Severe Storms, Tornadoes, Flooding	61	18		43
			Cities: 1		
October 14, 1998	Severe Storms, Flash Flooding	19		14	5
Oct. 19, 1998**	Severe Storms, Flash Flooding	2	2		
			Cities: 1		
April 20, 1999	Storms and Flooding	6	6		
May 12, 2000	Severe Storms, Flash Flooding	10	1		10
February 6, 2002	Severe Ice Storm	64	38	22	4
May 6, 2002	Severe Storms, Tornadoes	37	22	15	
			15		
May 6, 2003	Severe Storms, Tornadoes	76	45	2	29

\* IA denotes individual assistance; PA denotes public assistance.

\*\* Declaration was for incident in July 1998, and approved October 19, 1998, following State appeal.

**Table 9** shows the total amount of public assistance eligible for disaster declarations in Missouri from 1990 through 1998. Public assistance includes state and federal assistance for uninsured losses to public property and infrastructure within those counties included in the disaster declaration.

**Table 9. Public Assistance for Missouri Flood Disasters, 1990-1998**

<b>Date</b>	<b>Disaster Recovery (DR) No.</b>	<b>Number of Applicants</b>	<b>Damage Survey Reports</b>	<b>Total Amount Eligible</b>
Spring 1990	0867	72	2,023	\$9,461,555
Summer 1993	0995	901	14,479*	\$140,859,657*
Fall 1993	1006	38	565*	\$3,281,066*
Spring 1995	1054	329	2,275*	\$17,404,027*
Fall 1998	1253	104	869	\$11,217,783*
<b>Totals</b>		<b>1,444</b>	<b>20,211*</b>	<b>\$182,224,088*</b>

\* Figures as of June 1999

**Table 10** shows the total amount of individual assistance for individual assistance (IA)-declared disasters in Missouri from 1990 through 1998. Individual assistance includes state and federal assistance to individuals and families for uninsured losses within those counties included in the disaster declaration.

**Table 10. Individual Assistance for Missouri Flood Disaster, 1990-1998**

<b>Date</b>	<b>Disaster Recovery (DR) No.</b>	<b>Total Number of Applicants</b>	<b>Individual Assistance</b>
Spring 1990	867	700	\$4,000,000
Spring 1993	989	447	\$1,591,241
Summer 1993	995	15,478	\$65,690,976
November 1993	1006	673	\$2,796,562
Spring 1994	1023	779	\$2,116,639
Spring 1995	1054	1,868	\$4,297,039
July 1998	1256	1,763*	\$1,093,865
Fall 1998	1253	1,623*	\$1,251,679
Spring 1999	1270	203*	\$559,725
<b>Totals</b>		<b>23,534</b>	<b>\$83,397,726</b>

\* Figures as of June 1999.

**Table 11** shows the total projected federal expenditures through September 30, 1994, for four major disasters.

**Table 11. Federal Disaster Expenditures**

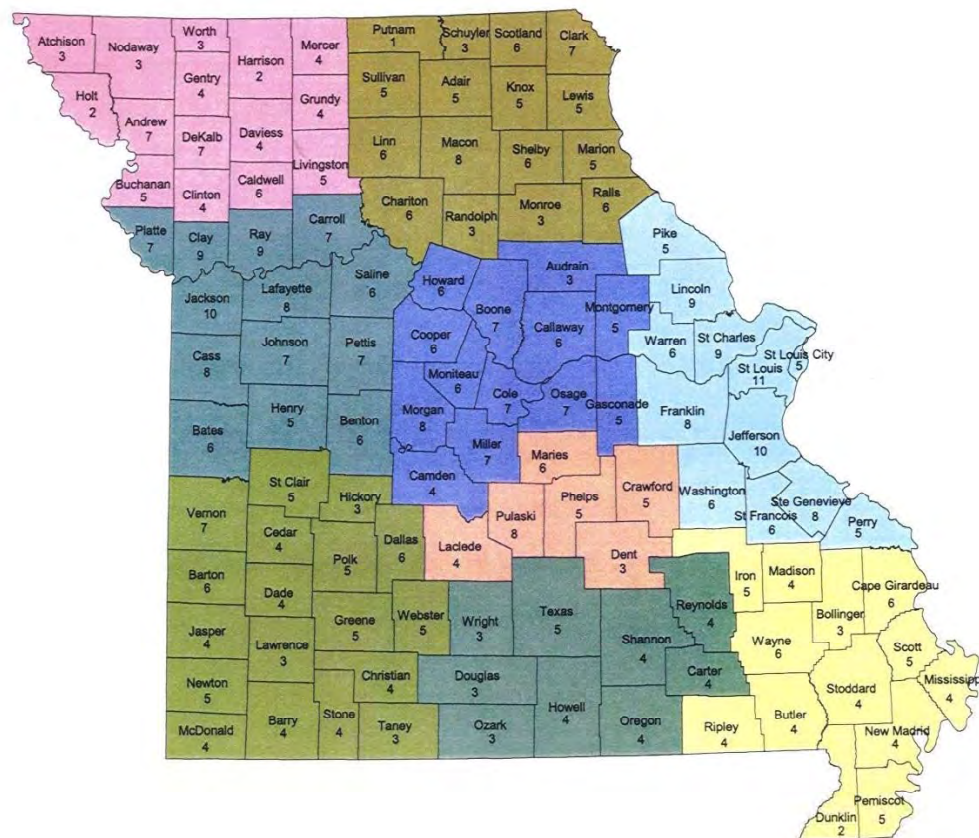
Disaster Incidents	Declaration Date	Projected Federal Expenditures (in Millions of Dollars)*
Hurricane Andrew	August 1992	3937.1
Hurricane Iniki	September 1992	554.2
<b>Midwest Floods</b>	<b>Summer 1993</b>	<b>6011.7</b>
Northridge Earthquake	January 1994	3714.6

\* Expenditures through September 30, 1994.

**Figure 12** shows the number of declared disasters between 1993 through 2003 by county.

**Figure 12. Declared Disasters (1993 – 2003)**

## Declared Disasters 1993-Present



### **3.2.1 Attack (Nuclear, Conventional, Chemical, and Biological)**

#### **Historical Statistics**

- During World War I (1915-1918), chemical and conventional weapons were used. The first poison gas, chlorine, was used by the Germans against Allied troops in 1915. The effects of the gas were devastating, causing severe choking attacks within seconds of exposure. The British subsequently retaliated with chlorine attacks of their own, although reportedly more British suffered than the German troops, because the gas blew back into their own trenches. Phosgene was later used in the war because it caused less severe coughing, resulting in more of the agent being inhaled. Then, in September 1917, mustard gas was used in artillery shells by the Germans against the Russians. Mustard gas caused serious blisters, both internally and externally, several hours after exposure. In all, there were 1,240,853 gas-related casualties and 91,198 deaths from gas exposure during World War I.
- During World War II (1941-1945), atomic (nuclear), chemical, and conventional weapons were used. Use of chemical weapons in World War II was not as prevalent as in World War I, and was primarily limited to the Japanese Imperial Army. During the war, the Japanese used various chemical-filled munitions, including artillery shells, aerial bombs, grenades, and mortars, against Chinese military forces and civilians. Chemical agents used included phosgene, mustard, lewisite, hydrogen cyanide, and diphenyl cyanarsine. The war was brought to an abrupt end in 1945, when the U.S. dropped two atomic bombs on Japan: one on Hiroshima that obliterated the entire city and killed approximately 66,000 people, and another on Nagasaki that destroyed about half the city and killed about 39,000 people.
- During the Vietnam War (1964-1973), chemical and conventional weapons were used. Chemical weapons used during the Vietnam War are believed to have only involved tear agents used by the U.S., and possibly psychedelic agents, also by the U.S. Although not directly used as warfare agents, toxic herbicides such as Agent Orange were commonly used as defoliants by the U.S. Long-term exposure to Agent Orange, which contained the contaminant dioxin, was believed to cause illness and disease in humans.
- In 1983, Iraq launched its first of 10 documented chemical attacks against Iran. The largest of these attacks was in February 1986, when mustard gas and the nerve agent tabun were used, impacting up to 10,000 Iranians. Although the exact number of chemical attacks implemented by Iraq during the war is unknown, the Iranian government estimates that more than 60,000 soldiers had been exposed to mustard gas and the nerve agents sarin and tabun by the time the war ended in 1988. Based on these data, Iraqi chemical attacks during the Iran-Iraq war were the largest since World War I.
- Although several isolated attacks involving biological agents have occurred over the last few decades, the most recent series of incidents in the U.S. that gained nationwide exposure occurred between early October and early December 2001, when five people died from anthrax infection, and at least 13 others contracted the disease in Washington, D.C.; New York City; Trenton, New Jersey; and Boca Raton, Florida. Anthrax spores were found in a number of government buildings and postal facilities in these and other areas. Most of the confirmed anthrax cases were tied to contaminated letters mailed to media personalities and U.S. Senators. Thousands of people were potentially exposed to

the spores and took preventive antibiotics. Numerous mail facilities and government buildings were shut down for investigation and decontamination. In the wake of these incidents, federal, state, and local emergency response agencies across the United States responded to thousands of calls to investigate suspicious packages, unknown powders, and other suspected exposures. Fortunately, almost all of these incidents turned out to involve no actual biohazard.

### **Measure Of Probability And Severity**

Attacks against the United States as a whole, and against individual states or local entities, can be categorized as originating from either domestic or international sources. However, because the impacts on life and property would largely be the same regardless of the source of such an attack, similar preparedness, response, and recovery activities apply.

Biological and chemical weapons have often been used to terrorize an unprotected population, instead of actual use as weapons of war. However, the potential damage that can occur in the event of such an attack is huge, particularly to human health.

A single nuclear weapon detonation could cause massive destruction, and all aforementioned types of attacks could cause extensive casualties. An all-out nuclear attack could affect the entire population in the vicinity of the impacted area. Some areas would experience direct weapons effects: blast, heat, and initial nuclear radiation. Other areas would experience indirect weapons effects, primarily radioactive fallout. As long as world leaders maintain rational thinking, the probability of an attack by any of the aforementioned methods remains low.

Secondary effects of these attacks, which could severely stress the country, include lack of adequate shelter, food, water, health and medical facilities and personnel, and mortuary services, disruption of communication systems, and power outages. Because of the potential devastation and significant secondary effects caused by this type of attack, the severity is rated high.

### **Impact Of The Hazard**

The population is vulnerable to two separate categories of impacts associated with these types of attacks: direct and indirect impacts. For more information on these impacts, which are often connected to terrorist-related activities, see the Terrorism section of this document.

### **Direct Effects**

These are effects directly associated with detonation or use of the weapon.

- **Conventional Weapons** – Direct effects of conventional weapons generally are related to injuries inflicted by penetration of ammunition rounds or shrapnel from exploding ordnance (mortars, etc.). Injuries from shock waves/blast overpressure near the targets may also occur, along with damage caused by fires produced from incendiary warheads, grenades, and other munitions. In addition, some injuries may occur as a result of flying or falling debris where the weapons are used. Heavy artillery use can also damage roadways and buildings, and disrupt utility services for lengthy periods of time.
- **Chemical and Biological Weapons** – Direct effects of chemical weapons involve initial spread of agents and fragmentation of the weapons. Chemical agents are toxins used to produce neurological and pulmonary injuries or death. Biological agents are infectious microbes used to produce illness or death. They can be dispersed as aerosols or airborne



particles directly onto a population, producing an immediate effect (a few seconds to a few minutes for chemical agents) or a delayed effect (several hours to several days for biological agents). Severity of injuries depends on the type and amount of the agent used and duration of exposure. Because some biological agents take time to grow and cause disease, an attack using this type of agent may go unnoticed for several days.

- **Nuclear Weapons** – Direct effects include intense heat, blast energy, and high-intensity nuclear radiation. These effects generally will be limited to the immediate area of the detonation (up to 22 miles), depending on weapon size, altitude of burst, and atmospheric conditions.
- **Agroterrorism** – The direct effect of agroterrorism is the intentional use of a biological weapon on livestock and food crops to disrupt the food supply chain. Agroterrorism will cause disease in livestock, crops, and humans who consume food products. It will require the agriculture industry to destroy livestock and food crops.
- **Radiological Weapon** – Direct effects of a radiological weapon are penetration by shrapnel by the blast, radiological poisoning from penetration of radiologically contaminated shrapnel, and ingestion of minute radiological particles. A Radiological Dispersion Device (RDD) or “dirty bomb” will contaminate an area by penetration of shrapnel into structures and settlement of dust and debris on the area.
- **Explosive Weapon (large amount of high explosive)** – The direct results of an explosive weapon are immense destruction caused by the blast and multiple fatalities. Instances of these effects include Oklahoma City, Kobhar Towers, the marine barracks in Lebanon, and the African Embassy bombings.

### Indirect Effects

These are effects not directly associated with the detonation and use of the weapon.

- **Conventional Weapons** – Unexploded ordnance throughout a battle zone or explosion hazards to those in the area can persist after warfare has ended. Many conventional munitions also contain toxic compounds that can leach into surrounding soils and groundwater if left in place.
- **Chemical and Biological Weapons** – Indirect effects are generally limited to downwind areas. They can be geographically widespread and vary in intensity—depending on weapon size, type of chemical or biological agent, and wind patterns. The spread of these agents can contaminate food and water supplies, destroy livestock, and ravage crops.
- **Nuclear Weapons** – When a nuclear weapon explodes near or on the ground, it draws up large quantities of earth and debris into a mushroom cloud. This material becomes radioactive, and the particles can be carried by wind hundreds of miles before they drop back to earth as “fallout.” In an attack, many areas of the United States would probably escape fallout altogether or experience non-life-threatening levels of radiation. However, because weather that determines where fallout will land is so unpredictable, no locality in the United States is free from risk of receiving deadly radiation levels after a strategic attack.
- **Agroterrorism** – Agroterrorism’s indirect effects are loss of breeding stock to replenish herds and flocks, loss of seed crops, and possibly loss of land use for a long period of

time depending on the disease involved. Agroterrorism has a high probability of creating an economic downturn.

- **Radiological Weapon** – The indirect effect of a RDD is inability to use the contaminated area for a short-to-long time period, depending on the identification of the radioactive material. Because radioactive material from a RDD can penetrate wood, asphalt, concrete, and masonry (and radioactive dust and particles can enter the smallest crevices), decontamination will be extremely difficult or impossible.
- **Explosive Weapon (large amount of high explosive)** – The indirect effect of an explosive weapon is the fear, terror, and lasting psychological damage done to survivors and other individuals.

### **Synopsis**

Even though the START treaty has reduced the overall number of nuclear weapons, and many chemical weapons stockpiles are scheduled to be destroyed, we must continue to plan for, and be prepared for, this type of hazard.

While it may not be possible to prevent such an attack, steps can be taken to lessen the likelihood or the potential effects of an incident by implementing certain measures:

- Identifying and organizing resources;
- Conducting a risk or threat assessment and estimating losses;
- Identifying mitigation measures that will reduce the effects of the hazards and developing strategies to deal with the mitigation measures in order of priority; and
- Implementing the measures and evaluating the results (and keeping the plan up-to-date).

## **3.2.2 Civil Disorder**

### **Historical Statistics**

**Missouri** – Fortunately, Missouri has not experienced a trend of consistent riotous behavior or disruptive civil disorder, as some other states have witnessed in the past several decades. While far from recent, Missouri's most notable incident is the famous 1954 prison riot in Jefferson City, which stands as the state's worst-case example of a full-scale riot. Other events in Missouri's early history, as well as those in the late 1960s through this decade, indicate the state is not immune to riots, protests, and social upheaval, but no event caused the destruction that occurred during the 1954 prison riot. Some brief examples of Missouri's riotous events are provided below.

- In the spring of 1832, citizens in Jackson County began to show their hostility toward Mormon newcomers by stoning their houses. In July 1833, a public meeting to determine the Mormon question resulted in demands that no more Mormons be allowed to settle there, that Mormons already residing in the county move out immediately, and that the Mormon newspaper (the Evening and Morning Star) be suspended. When the Mormon settlers refused these demands, the citizens razed the newspaper office, threw the press in the Missouri River, and tarred and feathered two Mormons. The Mormons appealed their plight to Governor Daniel Dunking, who issued a decision denying any citizen the right to take into his own hands the redress of grievances. He recommended that the Mormons

take their case to civil courts to uphold their rights. Incensed by this action, about 50 armed men attacked a Mormon settlement called Big Blue near Independence on October 31, 1833, beating several of the men and destroying 10 homes. Hostilities continued the next two nights. On November 4, a band of citizens fought about 30 Mormons at Big Blue; three citizens, including one Mormon, were killed. Feeling they were outnumbered, most of the Mormons left the county as a result. The few who remained eventually left as well due to continued threats and hostilities.

- In 1906 on the night before Easter Sunday in Springfield, a mob of 6,000, fueled by alcohol and rumors of a white woman's rape, battered down the jailhouse doors and carried away three black men who were then hanged in the town square. Within hours, new rumors spread that black neighborhoods were about to be destroyed. Hundreds of black people fled before the state militia arrived to restore order. In the months that followed, a grand jury indicted more than a dozen people for the hangings, and the story of the woman's attack proved to be untrue. Only one person went to trial, however, and the jury deadlocked without reaching a verdict. In her book about the incident and its aftermath, "Many Thousand Gone," Katherine Lederer notes that until 1906, Springfield had a thriving black population, but the population has never recovered.
- On September 22, 1954, a full-scale riot broke out at the Men's State Penitentiary in Jefferson City at about 6 p.m., after an inmate released several prisoners. The inmate had obtained keys from a guard by a ruse. At 7:00 p.m., all available state highway patrolmen were directed to report to the penitentiary as quickly as possible to quell the riot. Several buildings and vehicles were burning at that time, and some 500 inmates were loose, hurling bricks, yelling, and attempting violence. Both chapels were ablaze, as well as several prison shops and factories. Seeing the fires, which were visible at dusk from about 20 miles away, prisoners at the Alcoa reformatory and the women's prison staged separate rebellions there. Damage to state property at those facilities was minimal, but at the main prison, only cell houses and buildings equipped with sprinklers survived. By 11:30 p.m., 285 patrolmen in 202 cars were on the scene, and by midnight, some 100 St. Louis policemen carrying submachine guns had arrived by special train. They surrounded cell houses B and C—the only halls in which guards were still held hostage. Highway patrolmen and arriving National Guardsmen took positions on rooftops overlooking the quadrangle—a yard between the larger cell houses. From that vantage point, they opened fire, seriously wounding many inmates in the exchange. Shortly after 7 a.m. the next day, the last guard taken hostage was released, and the rioters, having no alternative, gave up shortly thereafter. By mid-morning, 2,000 police officers and National Guardsmen were on duty at the prison. When the riot was finally over, three inmates had been killed, and 21 wounded by gunfire. One other prisoner was murdered by stabbing and beating, and eight others were injured in fighting with each other. Five buildings were completely destroyed, and two others partially destroyed, resulting in more than \$10 million in losses to state property.
- On October 23, 1954, another riot occurred at the State Penitentiary while state troopers were still technically operating the institution. This melee was between white and black inmates, starting over food. Bricks began to fly, followed by gunfire from the troopers. Approximately 35 prisoners were wounded in that incident.

- On the evening of March 19, 1958, at Alcoa Intermediate Reformatory, east of Jefferson City, quick action by then Governor James T. Blair and a contingent of state highway patrolmen with riot guns quelled a potential inmate uprising. The governor himself and the patrolmen entered the facility amid reports of unrest following the resignation of the institution's acting superintendent. When no trouble occurred, the troopers were removed after about 2 hours.
- On April 9, 1968, the Kansas City Police Department requested the help of the Missouri Highway Patrol in quelling rioting, bombing, and looting in the eastern part of the city in the wake of the Martin Luther King assassination. Over 200 officers reported to the staging area at District Four of the State Highway Department to receive their assignments, and began patrolling the downtown area. Officers arrested numerous persons for charges ranging from curfew violations to felonious assault. They remained on duty for 10 days until peace was restored.
- Twice in May 1969, demonstrations at Lincoln University in Jefferson City resulted in about 200 highway patrolmen being called to the scene to combat arson, sniper fire, and vandalism on campus. The Student Union was burned during those demonstrations.
- On February 17, 1975, at Alcoa Intermediate Reformatory, a minor riot broke out, resulting in tear gas being thrown into dormitories at the institution. Three prison officials suffered minor injuries, and one inmate required stitches to close a wound. The incident resulted in about \$5,000 in property damage.
- In December 1977 and January 1978 in Southeast Missouri, farmers making up an American Agricultural Movement staged demonstrations to protest what they felt were unfair prices for their products, as maintained by government price supports. The rallies continued through April 1978, with picketing, tractorcades, and stoppage of highway traffic throughout the area, despite high winds, ice, and snow. More than 300 farm tractors were involved in at least one of these actions. On January 11<sup>th</sup>, highway patrol troopers on Interstate 55 (I-55) near Hayti arrested seven farmers and charged them with failure to obey a reasonable request, assault, and damaging state property. Four others were arrested on I-55 near Caruthersville for driving their pickup trucks slowly side by side, preventing traffic from passing. Twenty-five farmers with their tractors were involved in a fracas with 12 officers near Hayti. Two patrol cars were damaged, and one officer sustained minor injuries when shoved by an irate farmer into the path of a road grader.
- On April 29, 1992, in Warrensburg, racial tensions mounted following the announcement of the controversial Rodney King verdict. The Johnson County Emergency Operations Center was activated for several hours as police remained on alert status for a potential serious disturbance. Military police from nearby Whitman Air Force Base were also placed on standby alert status, but no major problems occurred.

**United States** – Incidents of civil disorder that erupted into violence are part of American history, spanning several centuries. In March 1770, just prior to the Revolutionary War, a riot occurred when Boston citizens taunted British soldiers and began throwing things at them during a demonstration. Five people were killed when the troops fired during the incident, which became known as “The Boston Massacre.” Three years later, on December 16, 1773, a group of

Boston citizens protested the British tax on tea to the colonies by throwing it overboard. The “Boston Tea Party” was a harbinger of troubles that eventually led to the Revolutionary War.

- On May 4, 1886, another violent event occurred in Haymarket Square in Chicago when a confrontation took place between police and strikers at the McCormick reaper works. A bomb was thrown and a gun battle erupted, during which seven police officers and four workers were killed. Many police and civilians were also injured in what became known as the “Haymarket Square Riot.”
- Controversy over civil rights and the unpopular war in Vietnam during the 1960s and 1970s resulted in one of the most turbulent periods in American history. During this same time, major riots occurred in Los Angeles in 1965; Detroit in 1967; Chicago in 1968 during the Democratic National Convention; Santa Barbara, California, in 1970; East Los Angeles, California, in 1970 and 1971; and Attica, New York, in 1971, during a major prison riot. Violent rioting once again erupted across the country on April 29, 1992, when four police officers were acquitted after being accused of beating a black suspect (Rodney King). Also in recent years, issues such as abortion, gay rights, immigration, and gun control have generated great public debate and resulted in many mass assemblies and demonstrations.

### **Measure Of Probability And Severity**

Across the nation, police reports reflect a fairly steady rate of theft, mugging, arson, and homicide incidents. But these criminal acts do not amount to “riots.” In their article on “Understanding Riots” published in the Cato Journal (Vol. 14, No 1), David D. Haddock and Daniel D. Polsby note that a large crowd itself is not an incipient riot merely because it assembles a great many people. Haddock and Polsby explain that “starting signals” must occur for civil disorder to erupt; these starting signals include certain kinds of high profile events. In fact, incidents can become signals simply because they have been signals in the past. In Detroit, for example, Devils Night (the night before Halloween) has in recent years become a springboard for multiple, independent, and almost simultaneous acts of arson. With any conventional triggering event, such as news of an assassination or unpopular jury verdict, crowds form spontaneously in various places as word of the incident spreads, without any one person having to recruit them. But since not every crowd threatens to evolve into a riot, the authors reason that a significant number of people must expect and desire that the crowd will become riotous. In addition, “someone has to serve as a catalyst – a sort of entrepreneur to get things going.” A typical action is the breaking of a window (a signal that can be heard by many who do not necessarily see it). Someone will throw the first stone, so to speak, when he calculates the risk of being apprehended has diminished to an acceptable level. This diminished risk is generally based on two variables – the size of the crowd relative to the police force and the probability that others will follow if someone leads. The authors conclude that once someone has taken a risk to get things started, the rioting will begin and spread until civil authorities muster enough force to make rioters believe they face a realistic prospect of arrest.

Nationwide, riots are apt to be a recurrent, if unpredictable, feature of social life. Without question, Missouri will continue to experience future episodes of marches, protests, demonstrations, and gatherings in various cities and communities that could lead to some type of disruptive civil disorder. However, based on the state’s general history of civil disturbance and

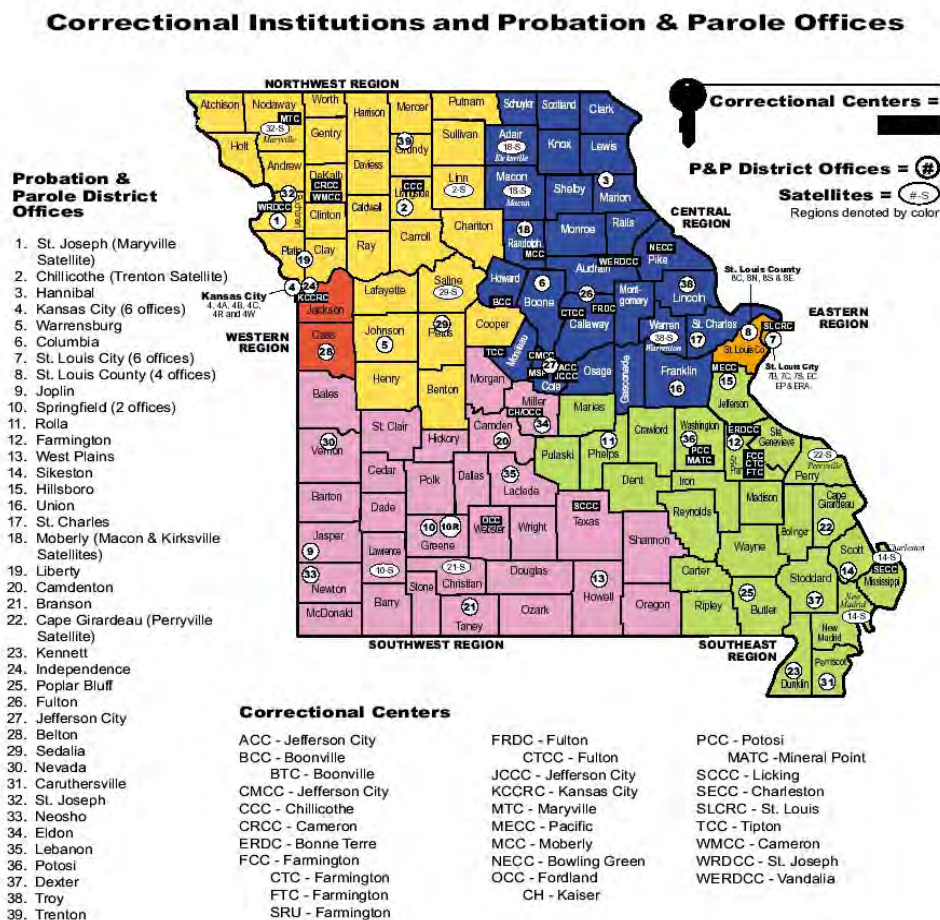
the various human factors noted above, the probability that such incidents will develop into full-scale riots is considered low.

Regarding penal institutions, much has been done in Missouri and other states to alleviate living conditions, which are underlying factors in many riots (prison overcrowding, poor treatment of inmates, lack of grievance procedures, etc.). The State has been building new prisons for several years, or expanding facilities to create more space and otherwise improve its facilities for its inmate population. As of June 30, 2002, 29,802 inmates were housed in the 21 state correctional centers. A map of the correctional institutions and probation and parole offices in the state is provided as **Figure 11**. One federal prison is located in the state, in Springfield. Plans are now underway for a new men's maximum-security prison to replace the 130-year-old Jefferson City Correctional Center (site of the 1954 riot), with several potential sites also being examined by the State.

Should Missouri experience future incidents of disruptive civil disorder or rioting, the severity of a given event could range from low to high, depending on many factors. A spirited demonstration that gets out of hand may result in several arrests, minor damage to property (police vehicles with broken windows, etc.), some injuries, and manpower/overtime costs for police, fire, and other response services. To a greater extent, the threat of urban or inner city riots has the potential for millions of dollars in property damage, possible loss of life and serious injuries, and extensive arrests. Sustaining police at the scene for extended periods, and possibly mobilizing state highway patrol and National Guard units, can add to the extensive manpower costs. Still, such riots tend to be confined to a single site or general area of a community rather than multiple locations or several areas of the state at the same time. Once a riot has occurred, police in other cities are generally on standby for possible riotous conditions and are better able to alleviate potential disturbances before they develop into full-scale riot events.

**Figure 13** shows the correctional institutions and probation and parole offices by county.

**Figure 13. Correctional Institutions and Probation & Parole Offices Map**



### **Impact Of The Hazard**

When rioting does break out, it generally proves extremely difficult for first-responder law enforcement authorities to quell the mob promptly. The rules of Constitutional law set stringent limits on how police officers can behave toward those whom they try to arrest. Restraint also plays a crucial part in avoiding any action that “fans the flames.” Initial police presence is often undermined because forces may be staffed below the peak loads needed to bring things back under control. At a result, the riot may continue until enough state police or National Guard units arrive to bolster the arrest process and subsequently restore order. In many cases, damage to lives and property may already be extensive.

### **Synopsis**

In the wake of numerous urban riots in the late 1960s and beyond, a unique approach in law enforcement began to emerge as a viable means to reduce the risk of such future riots. Known as “Community Policing,” its philosophy rests on the belief that reducing and controlling serious crime requires the police to pay renewed attention to all problems that allow serious crime to occur. In its comprehensive report following the devastating 1967 Detroit riot for example, the Kerner Commission noted that police “cannot, and should not, resist becoming involved in community service matters.” The benefits to law enforcement and public order, the Commission says, include the following:

Because of their “front-line position” in dealing with ghetto problems, police will be better able to identify problems in their community that may lead to disorder.

- They will be better able to handle incidents requiring police intervention.
- Willing performance of such work can gain police the respect and support of the community.
- Development of non-adversary contacts can provide the police with a vital source of information and intelligence concerning the communities they serve.

In his paper entitled “Preventing Civil Disturbances: A Community Policing Approach,” Michigan State University professor Robert C. Trojanowicz says community policing can reduce the potential for riots beyond simply reducing racial tensions between the police and the black community. The organizational strategy of community policing, he writes, “requires freeing some police officers from the isolation of the patrol car, so they can work directly in the community and enlist them as partners in the process of policing themselves. It addresses the need that everyone in the U.S. deserves to live in a safe and stable community, free of drugs and violence, and reminds us that “until we are all safe, no one is safe.”

Four basic ways community policing can help in riot prevention, the author says, are as follows:

1. It provides a means of gathering superior intelligence that allows us to identify areas at risk, the level of threat in those areas, and weaknesses and strengths within the community.
2. It provides the police with a way to address those weaknesses, which often include crime, violence, drugs, fear of crime, disorder, neighborhood decay, and juveniles at risk.
3. It reaches out to law-abiding people in the community and involves them in the police process, serving as the vital link required to enlist their help in actively promoting order and stability.
4. It reduces the overall risk to riots by improving the relations between the police and the black community.

A community policing officer (CPO), the author notes, is a full-fledged law enforcement officer who makes arrests, but is further challenged to find new ways to address old problems. CPOs act as community advocates for needed neighborhood services (prompt trash pickup, demolition of abandoned buildings, etc.) and serve as community liaison to public and private agencies, Trojanowicz writes. “This can mean linking troubled families to affordable counseling services, linking the homeless to shelter, or tapping local business to provide donated supplies for projects to beautify the area.” The initiatives are bounded only by the collective imagination of the CPO and the people in the community and their local needs, the author concludes.

### **3.2.3 Dam Failure**

#### **Historical Statistics**

Missouri had some 4,100 recorded dams in July 2003, the largest number of man-made dams of any state in the United States. The topography of the state allows lakes to be built easily and inexpensively, which accounts for the high number. Despite such a large number, only about 620 Missouri dams (about 20 percent) fall under state regulations, while another 85 dams are



federally controlled. A non-federal dam can be anything from a large farm pond (e.g., MFA Research Farm Lake Dam in Saline County, which is 20 feet high and holds back 60 acre feet of water) to Bagnell Dam, which created the Lake of the Ozarks. Most non-federal dams are privately owned structures built either for agricultural or recreational use. Missouri also has some 600 dams that were built as small watershed projects under Public Law-566 (Watershed Protection and Flood Prevention Act of 1953). These dams serve many functions, including flood control, erosion control, recreation, fish and wildlife habitat, water supply, and water quality improvement. Many are nearing the end of their 50-year lifespan and are in desperate need of repair. Another group of older dams in the state were originally built by railroad companies as holding ponds for water to be used in steam locomotives. Many of these are now used as drinking water reservoirs by nearby towns and cities. **Table 12** depicts the number and percentages of the purpose of dams in Missouri. **Figure 14** illustrates the number of dams by county in the state of Missouri.

**Table 12. Dams In Missouri By Purpose**

Purpose	Number	Percent
Fire and Farm Ponds	381	10.8
Flood Control	285	8.0
Hydroelectric	8	0.2
Irrigation	296	8.4
Navigation	7	0.2
Recreation	1,826	51.6
Tailings and Others	487	13.8
Water Supply	243	6.9
Undetermined	8	0.1

Within the State of Missouri, the Department of Natural Resources Division of Geology and Land Survey maintains a Dam and Safety Program. The objective is to ensure that dams are safely constructed, operated, and maintained pursuant to Chapter 236 Revised Statutes of Missouri. Under that law, a dam must be 35 feet or higher to be state regulated. These dams are surveyed by state inspectors at least every 5 years. However, most Missouri dams are less than 35 feet high and thus, are not regulated. While the State has for many years encouraged dam owners to inspect those unregulated dams, the condition of many continues to deteriorate.

[illegible]

### Measure Of Probability And Severity

1. **High Hazard** – If the dam were to fail, lives would be lost and extensive property damage could result.
2. **Significant Hazard** – Failure could result in the loss of life and appreciable property damage.
3. **Low Hazard** – Failure results in only minimal property damage.

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**Table 13. Dams in Missouri by County and the Threat of Dam Failure by County**

County	Number of Dams	Hazard Potential Classification		
		High	Significant	Low
Adair	27	2	6	19
Andrew	22	4	7	11
Atchison	10	1	1	8
Audrain	85	5	23	57
Barry	1	0	0	1
Barton	31	0	4	27
Bates	23	2	7	14
Benton	25	3	5	17
Bollinger	27	4	8	15
Boone	123	28	26	69
Buchanan	29	5	8	16
Butler	30	1	8	21
Caldwell	18	1	4	13
Callaway	107	9	24	74
Camden	21	5	6	10
Cape Girardeau	29	12	4	13
Carroll	46	1	8	37
Carter	13	1	4	8
Cass	67	13	18	35
Cedar	11	1	1	9
Chariton	24	1	2	21
Christian	4	0	1	3
Clark	33	2	3	28
Clay	36	9	10	17
Clinton	25	1	7	17
Cole	30	5	15	10
Cooper	22	0	2	20
Crawford	76	8	21	47
Dade	11	0	1	10
Dallas	4	0	1	3
DeKalb	60	2	17	41
Dent	36	6	10	20
Douglas	5	0	2	3
Dunklin	2	1	1	0
Franklin	137	22	32	83
Gasconade	80	8	14	58
Gentry	19	1	4	14
Greene	18	10	3	5
Grundy	36	4	6	26
Harrison	112	2	44	64
Henry	39	0	6	33
Hickory	7	1	1	5
Holt	18	3	4	11
Howard	33	5	2	25
Howell	24	2	7	15
Iron	41	14	8	19
Jackson	77	27	18	32

County	Number of Dams	Hazard Potential Classification		
		High	Significant	Low
Jasper	14	2	3	9
Jefferson	149	60	48	41
Johnson	92	10	14	68
Knox	21	0	6	15
Laclede	18	0	7	11
Lafayette	187	2	41	144
Lawrence	7	0	0	7
Lewis	67	0	16	51
Lincoln	67	7	23	37
Linn	17	2	6	9
Livingston	59	1	16	42
McDonald	3	1	0	2
Macon	24	3	3	18
Madison	24	12	8	4
Maries	29	0	7	22
Marion	21	1	4	16
Miller	14	4	4	6
Mississippi	3	0	0	3
Moniteau	19	2	4	13
Monroe	24	2	5	17
Montgomery	84	10	18	55
Morgan	12	0	2	10
New Madrid	1	0	0	1
Newton	15	6	4	5
Nodaway	52	1	12	39
Oregon	9	2	1	6
Osage	21	3	10	8
Ozark	7	1	4	2
Pemiscot	3	0	0	3
Perry	32	12	7	13
Pettis	28	3	4	21
Phelps	29	4	8	17
Pike	46	2	16	28
Platte	26	7	8	10
Polk	13	0	2	11
Pulaski	14	0	0	14
Putnam	17	0	5	12
Ralls	29	5	8	16
Randolph	45	3	9	32
Ray	38	10	9	19
Reynolds	22	12	2	8
Ripley	24	0	8	16
St. Charles	113	19	28	65
St. Clair	15	0	1	14
St. Francois	63	20	23	20
Ste. Genevieve	50	18	16	16
St. Louis	42	22	14	6
St. Louis City	1	0	1	0

County	Number of Dams	Hazard Potential Classification		
		High	Significant	Low
Saline	23	2	4	17
Scotland	22	3	2	17
Scott	16	3	2	11
Shannon	9	1	3	5
Shelby	23	2	5	16
Stoddard	26	8	5	13
Stone	1	1	0	0
Sullivan	40	1	7	32
Taney	7	3	1	3
Texas	6	0	2	4
Vernon	43	1	5	37
Warren	125	28	46	51
Washington	119	51	34	34
Wayne	34	15	9	10
Webster	19	1	9	9
Worth	35	1	3	31
Wright	12	0	6	6

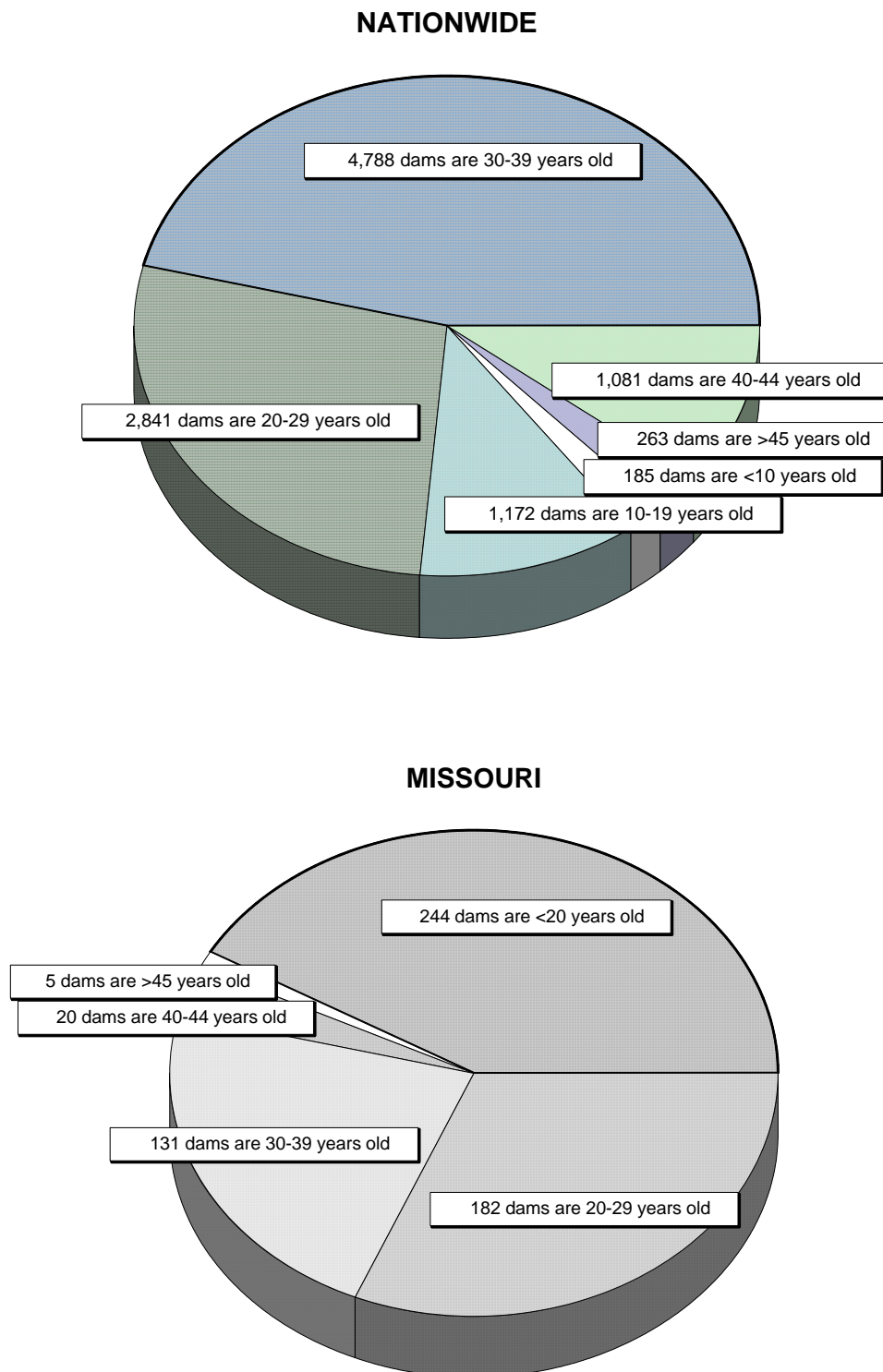
### Status of Missouri Privately-Owned Dams

According to the MDNR 2003 Missouri Dam Database, 622 dams, or 15 percent of the dams surveyed, had a high hazard potential, while 992 dams, or 25 percent of the dams surveyed had a significant hazard potential. Approximately 2,402 dams, or 60 percent of the dams surveyed had a low hazard potential. However, many of Missouri's unregulated, private dams have gone unchecked for decades, according to Jim Alexander, chief engineer for MDNR's dam safety program. Dams that don't get regular attention can erode over the years, or be damaged by floods, he notes. "There are accidents out there waiting to happen." Some of the potential hazardous dams are 5 miles from a downstream city. If a dam fails, the owner is still responsible for damage, Alexander says, "but there's no legal handle on them to maintain the dams." Information collected from the Corps of Engineers 1980 National Inventory of Dams is outdated, and ownership of unregulated dams may have changed. Concern is mounting even for some of the state's regulated dams; particularly the Silver Creek Dam east of Rockaway Beach in Taney County, where the ownership is unknown. Erosion is eating away at the 40-foot-high dam, and the runoff creates silt deposits along the shore of Lake Taneycomo. One end of the dam is a barren clay bank that could give way during a heavy rainstorm, Alexander says. MDNR's plans were to obtain money through the State Legislature to repair the dam, and have the Attorney General's Office seek reimbursement from the owner when that person is identified.

### Missouri's Small Watershed Projects with Dams

In 1954, Missouri built its first small watershed dam, and today has over 600 built under PL-566. These dams vary in size and perform multiple functions, including flood and erosion control. Many have a designed life of 50 years. According to a 1999 report, about 25 of these dams are more than 40 years old, and most will need major rehabilitation soon. More than 130 dams are 30 to 39 years old, while 182 of them are 20 to 29 years old (see **Figure 15**).

**Figure 15. Our Aging Dams: Survey of Small Watershed Dams**



The Iowa Watershed Task Force published a series of case studies in 1999 on aging watershed dams. The Missouri case study on the Tabo Creek Watershed Project in Lafayette County best illustrates the range of problems. The Tabo Creek project was authorized in 1960, with the first

dam constructed in 1961. Since then, 64 grade-stabilization dams have been installed. Many of these dams now face the same problems that plague older dams in other watersheds approaching the end of their 50-year design life. They include deteriorating pipes and sediment filling the reservoirs. The most common problem is decaying pipes, since 44 of the dams were installed with corrugated metal pipes. One of the most visible problems is the lakes filling with sediment. The Lafayette County Soil and Water Conservation District is responsible for operation and maintenance, and performs annual inspections of each structure. However, the local sponsors don't have the funds needed to rehabilitate all the structures, which would cost an estimated \$6 million, the case study notes. To date, no dams built under the Small Watershed Program anywhere in the U.S. have failed and resulted in loss of life or property. However, some exhibited significant problems that were corrected before a catastrophic failure or tragedy has occurred. The chances of such occurrences will undoubtedly increase, as the dams get older.

### **U.S. Army Corps of Engineers Operated Reservoir Dams in Missouri**

The U.S. Army Corps of Engineers (USACE) operates and maintains nearly a dozen large federally regulated reservoir dams in Missouri through its Kansas City, St. Louis, and Little Rock Districts. Extensive care is taken by USACE in the design, construction, and operation of their dams. As a result, the USACE record for dam safety is considered excellent. Nevertheless, dam failures elsewhere in the country raise the possibility that any one of these facilities could fail. The threat of an earthquake in some areas of the state, the possibility of sabotage or terrorist activities, or other natural or technological events are among the potential risk factors that could cause such a structure to fail.

For its regulated dams, the USACE Kansas City District began a program in 1999 to revise its Contingency Plans for seven district dams it operates in Missouri. The plans were republished as emergency action plans, to provide an updated emergency notification/points of contact list in the event of a dam failure; to provide for increased communications with local emergency management officials; and to provide a more simplified format for clarity. The USACE Kansas City District worked jointly with SEMA, NWS, and local officials, including the county sheriff and emergency management coordinator in the affected counties (24 hours below stream). The plans were updated for Pomme de Terre Dam (Hickory and Benton counties); Blue Springs Dam (Jackson County); Longview Dam (Jackson County); Smithville Dam (Clay and Platte Counties); Long Branch Dam (Macon and Randolph Counties); Stockton Dam (Cedar and St. Clair Counties); and Truman Dam (Benton and Morgan Counties). Two other counties, Schuyler and Putnam, were included in an updated plan for the Corps' Rathbun Dam in Iowa.

The USACE St. Louis District maintains flood emergency plans for its Clarence Cannon Dam/Mark Twain Lake project, with the plan covering Ralls, Monroe, Pike and Shelby Counties; and Lake Wappapello Dam for Wayne, Butler, Stoddard and Dunklin Counties. The USACE Little Rock District has similar plans for Table Rock Dam, Taney and Ozark Counties; and for Clearwater Dam, Wayne, Butler, and Reynolds Counties. **Figure 16** shows the location of the USACE's Missouri reservoir dams by county, and adjacent counties that could be impacted (emergency notification) by a dam failure.

**Figure 16. Missouri Counties With USACE Reservoir Dams**



Missouri's percentage of high hazard dams in the MDNR inventory puts the State at about the national average for that category. However, the probability of dam failure increases as many of the smaller and privately owned dams continue to deteriorate without the benefit of further regulation or improvements. Based on this information, the State rates the overall probability of dam failure as significant and the severity as moderate.

### **Impact Of The Hazard**

When a dam fails, the stored water can be suddenly released and have catastrophic effects on life and property downstream. Homes, bridges, and roads can be demolished in minutes. The failure of the Buffalo Creek Dam in 1972 in West Virginia killed 125 people. Should the Silver Creek Dam in Taney County fail, for example, the ensuing flood would likely take out a section of Missouri Highway 176, endanger other structures, and dump tons of silt into the lake. At least 26 recorded dam failures have occurred in 20 Missouri counties since the turn of the 20<sup>th</sup> century. Fortunately, only one drowning has been associated with a dam failure in the state, and there has been little consequence to property.

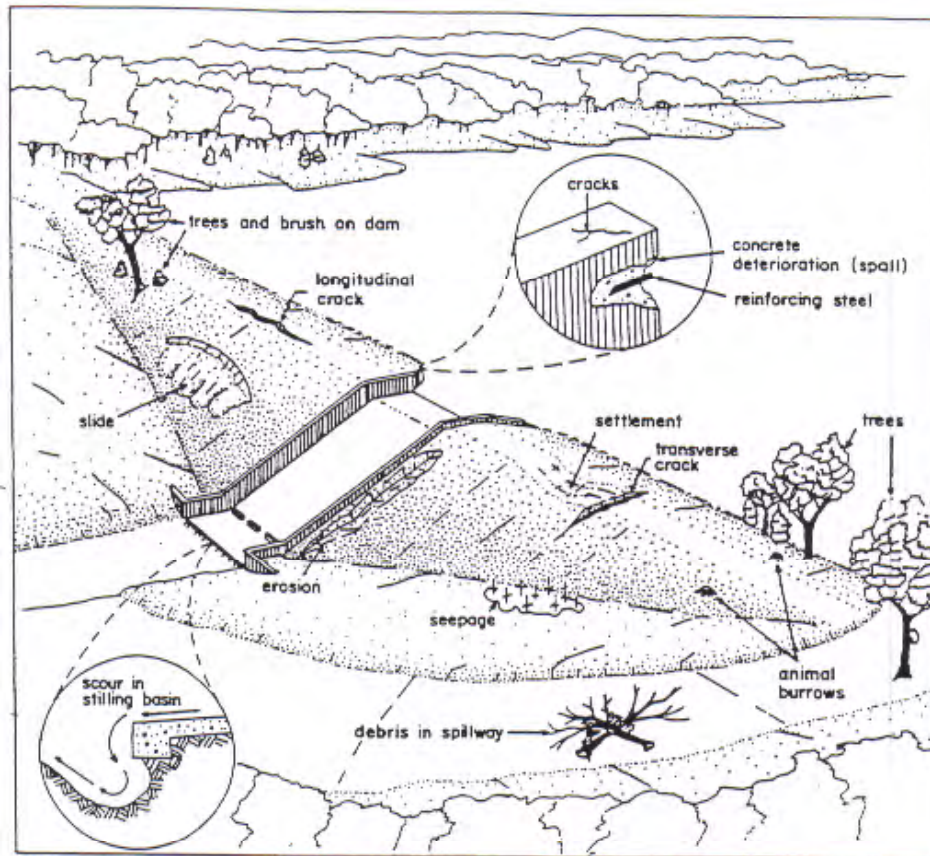
Residents near a high or moderate hazard dam should become familiar with the dam's emergency action plans. Emergency plans written for dams include procedures for notification and coordination with local law enforcement and other governmental agencies, information on the potential inundation area, plans for warning and evacuation, and procedures for making emergency repairs.



### **Synopsis**

Dam breaks are caused most often by failure of the structure itself. However, flooding is the most common hazard associated with dam failure. Prolonged rains and flooding can saturate earthen dams, for example, producing much the same breaching effect as occurs with earthen levees. Flooding can also result in overtopping of dams when the spillway and reservoir storage capacities are exceeded. A large slide may develop in either the upstream or downstream slope of the embankment and threaten to release the impounded water. Complete structural collapse can occur, especially as a result of an earthquake or severe tremors. **Figure 17** displays observable defects.

**Figure 17. Observable Defects**



Actual dam failure can result not only in loss of life, but also considerable loss of capital investment, loss of income, and property damage. Loss of the reservoir itself can cause hardship for those dependent on it for their livelihood or water supply. Loss of the reservoir itself can also upset the ecological balance of the area as well.

In the event of a dam failure, emergency warning/notification procedures are provided in both USACE flood emergency plans and local county emergency operations plans to alert local officials in the threatened areas. Emergency notification includes the county in which the dam is located, and adjacent/nearby counties below stream that may also be impacted. The USACE maintains emergency plans for each individual dam, and copies are kept on file with SEMA.

### 3.2.4 Drought

#### Historical Statistics

Missouri's average annual rainfall ranges from about 34 inches in the northwest to about 48 inches in the southeast. Even the driest areas of Missouri have more rainfall than most western states; however, lack of rainfall impacts certain parts of the state more than others because of alternate source availability and usage patterns.

**Southern Missouri**—Most of the southern portions of Missouri are less susceptible to problems caused by prolonged periods without rain because of abundant groundwater resources in the region. Even with decreased stream flows or lowered reservoir levels, groundwater is still a viable resource in southern Missouri. Row-crop farming is not extensive, and therefore agricultural needs aren't as great as in other parts of the state. The only exception is in the southwestern and southeastern areas where irrigation is used.

**Northern And West Central Missouri**—Most of the northern and west-central portions of Missouri are underlain by rocks that are not conducive to water-bearing formations. They yield only small amounts of water, even during periods of normal and above-normal rainfall. Under drought conditions, adequate amounts of water cannot be pumped from the rock formations of northern Missouri to supply even domestic needs. Most streams in northern Missouri do not receive appreciable groundwater recharge. During periods of drought, these streams are generally reduced to a series of pools, or may become completely dry. Streams and water impoundments are the only localized sources of water during droughts, and even these limited resources are at risk when the drought is prolonged. Agriculture in west-central and northern Missouri is usually the first to feel the effects of drought. Although row-cropping is more extensive in this part of the state, irrigation is generally not feasible except on the floodplains of major rivers.

**Drought of 1999-2000** – Most of Missouri, along with other states, was in a drought condition during the last half of 1999. The dryness did not begin until July 1999, but rapidly developed into a widespread drought by September. At that time, the Department of Natural Resources (MDNR) placed Missouri under a Phase I Drought Advisory level, and Governor Carnahan declared an Agricultural Emergency for the entire state. Agricultural reporting showed a 50 percent crop loss from the drought in 50 counties, with severe damage to pastures for livestock, corn crops, and Missouri's top cash crop—soybeans. On October 13, 1999, U.S. Agriculture Secretary Dan Glickman declared all Missouri counties agricultural disaster areas, making low-interest loans available to farmers in Missouri and contiguous states. The drought intensity increased through autumn and peaked at the end of November 1999. In fact, the five-month span between July and November became the second driest July-November period in Missouri since 1895, averaging only 9.38 inches of rain.

A wetter-than-normal winter diminished dry conditions in central and southern Missouri, but long-term moisture deficits continued to exist. At the same time, the remainder of the state (roughly north of the Missouri River) continued under drought conditions. Overall dry conditions returned through much of the state in March 2000, and costly wildfires and brush fires (70) erupted in many counties. By May, the entire state was under a Phase II Drought Alert

level, and on May 23, Governor Carnahan announced activation of the Missouri Drought Assessment Committee (DAC), made up of state and federal agencies and chaired by the MDNR Director. At a May 25, 2002, meeting, the DAC selected a subcommittee (guided by the Missouri Drought Response Plan) to determine the drought status of each county. In June, based on observations across the state and projections of future rainfall, the committee in June upgraded the drought status for 27 northern Missouri counties to Phase III, Conservation. This was based on concerns for water supplies and agricultural impacts. The City of Milan in Sullivan County was among the most severely affected in terms of water supplies. In June, a total of 80 Missouri counties remained under the Phase II Alert level, while seven counties in southeast Missouri (Butler, Dunklin, Mississippi, New Madrid, Pemscot, Scott and Stoddard) remained under Phase I Advisory conditions.

By mid-July 2000, some areas of northern Missouri benefited from additional rainfall, while drier conditions prevailed in other areas. At its July 12 meeting, the DAC revised its assessment, placing 30 counties under Phase III Conservation conditions, including 10 counties in the south-central area. The remaining 84 counties in the state were under Phase II Drought Alert conditions. This included seven counties in northern Missouri, which were downgraded from Phase III Conservation, and seven counties in Southeast Missouri, which were previously assessed as Phase I Advisory.

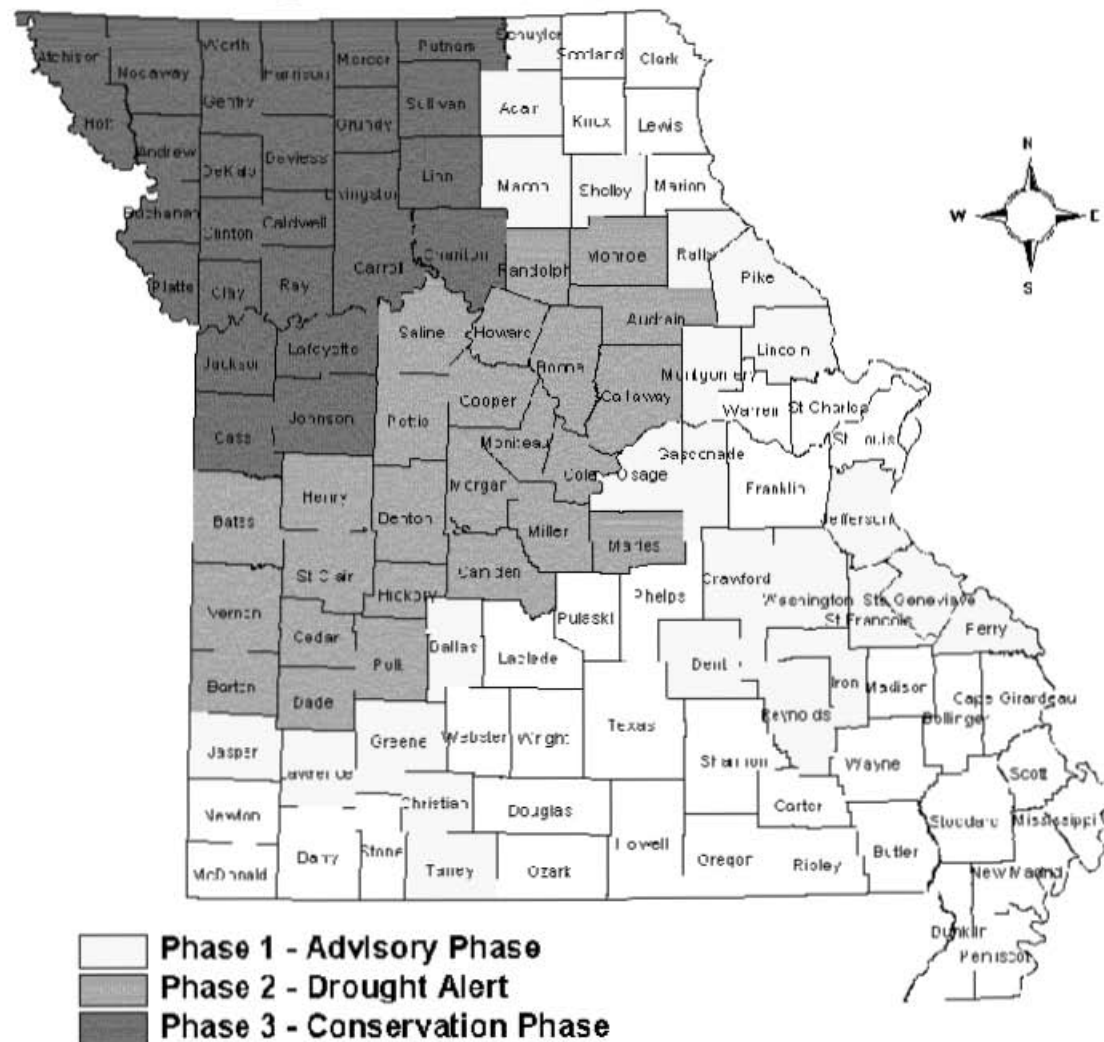
To ease the agricultural impact of the drought during the summer months, Governor Carnahan gained release of over 1 million acres from the Conservation Reserve Program (CRP) to provide farmers and ranchers in 21 counties additional sources to cut hay for livestock feed. Also, livestock producers in 16 counties were released from CRP contracts to allow cattle grazing on certain idle lands.

**Drought of 2002 and continuing** – The drought of 2002 caused tremendous financial hardships to many Missouri crop and livestock producers. The financial impact of the drought on producers in turn impacted the local communities and the state in terms of reduced economic activity. This drought cost an estimated \$460 million in 2002 in terms of Missouri's agricultural and economic productivity.

Drought conditions encompassed most of the northwestern quarter of Missouri. Severe drought conditions affected the northwest, west-central, and some portions of southwest Missouri, causing water conservation measures to be taken and restrictions to be imposed. For some areas, this was the second driest year since 1914; the only drier year was in 1988. This was the driest November – December period on record for northwestern and north-central Missouri.

**Figure 18** depicts the drought condition status as of August 12, 2003.

**Figure 18. Drought Condition Status (August 12, 2003)**



Climate and Weather Subcommittee

### **Measure Of Probability And Severity**

Because of its geographical location and characteristic weather patterns, Missouri is vulnerable to drought conditions. Agricultural droughts are the most common on record, particularly those inflicting damage to corn crop yields. Throughout much of this century, these droughts have occurred with common regularity (on the average of once every 5 years), according to the Missouri Crop and Livestock Reporting Service.

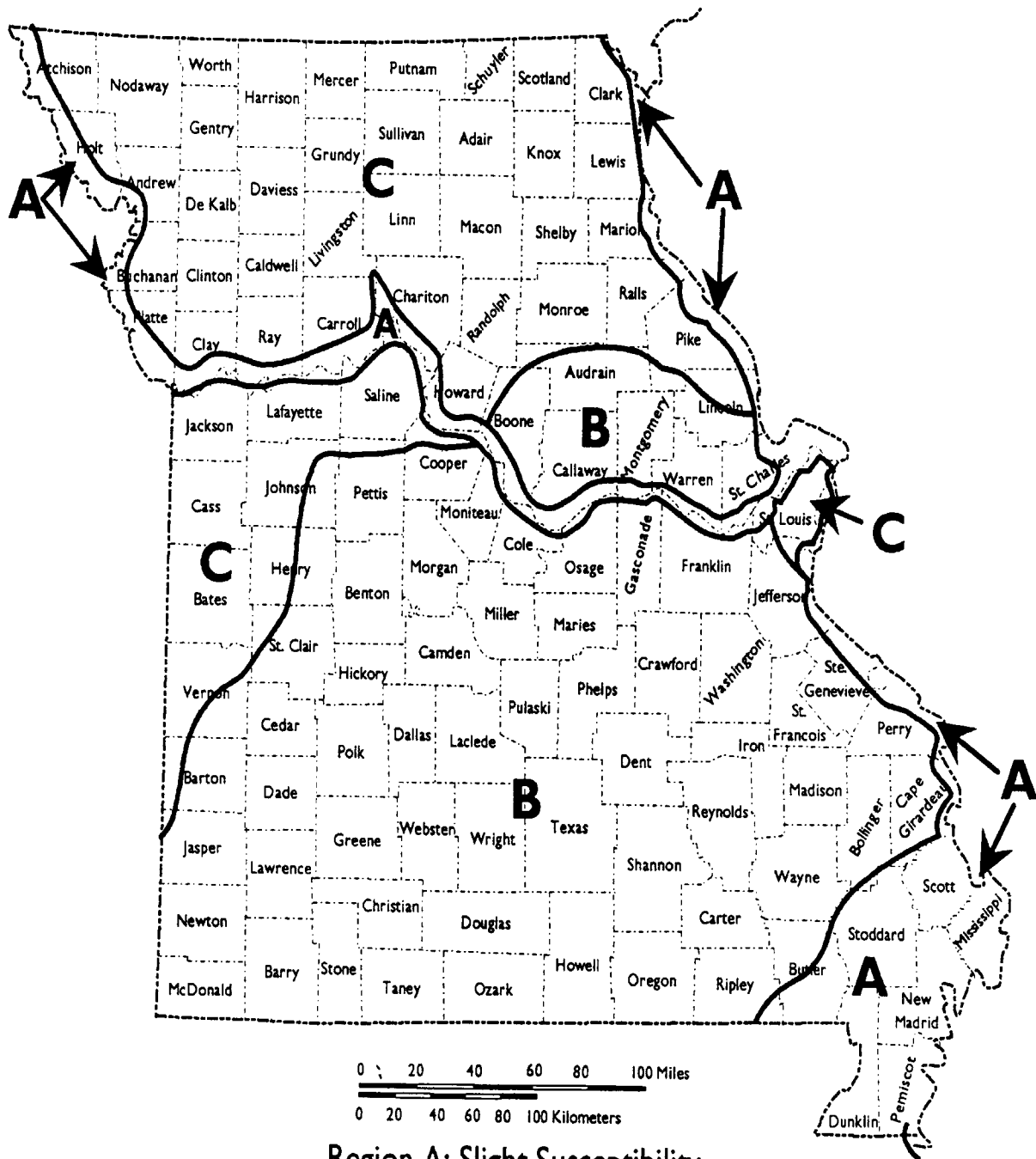
Based on Midwest drought data, MDNR, Water Resources Program produced a Missouri Drought Response Plan in 1995, with revisions in 2002. The plan's primary purpose is to address the need for state and local governments to coordinate advanced emergency planning, as during the drought of 1999-2000. The plan outlines proactive emergency and tactical measures designed to better prepare the state for drought. It also emphasizes the need for long-range strategic planning, which would address the bigger issue of drought impact avoidance. The plan notes that one of the major goals of drought mitigation is to prevent water shortages in public water systems.

In preparing the plan, divided the state into three regions, which are prioritized according to drought susceptibility. The regions are identified as having slight, moderate, and severe susceptibility to drought conditions, as illustrated in **Figure 19**. Descriptions of drought susceptibility for the three regions are as follows:

- **Region A (mostly Southeast Missouri)** has very little drought susceptibility. It is a region underlain by sands and gravel (alluvial deposits). Surface and groundwater resources are generally adequate for domestic, municipal, and agricultural needs.
- **Region B (Central, East-Central Missouri)** has moderate drought susceptibility. Groundwater resources are adequate to meet domestic and municipal water needs, but due to required well depths, irrigation wells are very expensive. The topography generally is unsuitable for row-crop irrigation.
- **Region C (Northern, West-Central Missouri; St. Louis County)** has severe drought vulnerability. Surface water sources usually become inadequate during extended drought. The groundwater resources are normally poor, and typically supply enough water only for domestic needs. Irrigation is generally not feasible. When irrigation is practical, groundwater withdrawal may affect other uses. Surface water sources are used to supplement irrigation supplied by groundwater sources.

The Missouri Drought Response Plan relies primarily upon the PDSI to indicate drought severity, and supports its findings directly with stream flow, reservoir-level, and groundwater-level measurements. Actions within the drought plan are triggered when the PDSI reaches certain levels. The DAC, chaired by the Director of the Department of Natural Resources, is activated in the Phase II Drought Advisory Stage. The DAC then activates the impact task forces, which cover the topics of agriculture, natural resources and environmental recreation, water supplies, wastewater and health, social, economic, and post-drought evaluations. Areas that appear to be the most vulnerable to drought are the focus of future drought planning, management, and mitigation activities. Based on this information, the State rates the probability and severity of the drought hazard as moderate.

**Figure 19. Drought Susceptibility**



Region A: Slight Susceptibility  
 Region B: Moderate Susceptibility  
 Region C: High Susceptibility

### **Impact Of The Hazard**

A severe drought in the Southern Plains states from the fall of 1995 through the summer of 1996 resulted in more than \$5 billion in costs and damages to agricultural regions (<http://www.btinternet.com/~mike.ferris/statistic2.htm>). The states of Texas and Oklahoma were most severely affected. In the summer of 1993, a combination of drought and a heat wave across the southeast U.S. was responsible for about \$1 billion in costs and damages. Among the most costly disasters, however, was the Great Drought of 1988-1989, which caused an estimated \$39 billion in losses in the United States. As a comparison, the record floods of 1993 in the Midwest inflicted damage in the range of \$12 to 16 billion. Although more subtle in terms of physical damage, the social and economic costs of drought are substantial.

Drought, as it affects the health and safety of Missouri citizens, is primarily a problem of rural water supply. With some exceptions, larger municipalities have not experienced major problems at levels that have caused impacts to some smaller communities. Most seriously affected are those supplied by small water structures. In its scope, a drought may be limited to a localized problem, or even a regional problem. Based on severity and duration, it may even become a statewide problem, at least in terms of overall impact, such as the commitment and shifting of resources and other response issues. Good water quality and a plentiful supply are two factors that we often take for granted. But when good water becomes a scarce commodity and people must compete for the available supply, the importance of these two factors increases dramatically. The State Water Resources Plan (RSMO 640.415), which is a provision of the Water Resources Law enacted by the Missouri Legislature in 1989, requires MDNR to ensure that the quality and quantity of Missouri's water resources are maintained at the highest possible level to support present and future beneficial uses. The provision was established to provide for the development, maintenance, and periodic updating of a long-range comprehensive statewide plan for the use of surface water and groundwater. It includes existing and future requirements for drinking water supplies, agriculture, industry, recreation, and environmental protection, and related needs.

### **Synopsis**

In addition to damage to crops, produce, livestock, and soil, and the resulting economic consequences, the arid conditions created by drought pose an increased risk of fire. The danger is especially high for brush fires, grass fires, and fires in wooded areas, which can threaten homes and other structures in their path. Lack of water resources in rural areas can complicate the firefighting efforts. During the spring 2000 drought, brush and wildfires erupted in numerous counties, resulting in a Governor's declared State of Emergency. The fires in Camden County were the most severe (See Fires, Section 3.2.6).

Severe drought also poses health threats to citizens due to water shortages and extreme heat. Particularly vulnerable are children, the elderly, and those with respiratory problems. Contaminated or poor water quality for drinking and sanitation measures can also cause serious illnesses. The Missouri Drought Response Plan addresses issues regarding water shortages and can be accessed via the MDNR Web site: [www.MDNR.mo.state.mo.gov/](http://www.MDNR.mo.state.mo.gov/).

### **3.2.5 Earthquake**

#### **Historical Statistics**

The most severe earthquakes occurred in the New Madrid fault zone during a period between December 16, 1811, and March 12, 1812. An engineer in Louisville, Kentucky, counted over 1,850 shocks during this time, including three earthquakes of magnitude greater than 8.3 (Richter magnitude). The shocks from these earthquakes could be easily felt as far away as Detroit, Michigan, and Charleston, South Carolina. The area between the St. Francois River and Mississippi River south of New Madrid to Marked Tree, Arkansas, showed numerous sand blows. A sand blow is a place where liquefacted alluvial soil has geysered out of the surface. Liquefaction is a phenomenon where the shaking of the ground separates the water from the soil holding it, causing the soil to behave like a dense liquid. The lack of water causes the soil to lose surface cohesion, and sand from these blows accumulates to a depth of up to 5 feet in places. Liquefaction causes land to lose its load-bearing capacity.

Areas uplifted as well as subsided (dropped) along the Mississippi River. For instance, the area around Tiptonville, Tennessee, formed a dome (uplift of several yards). Immediately adjacent to the Tiptonville Dome, an area subsided to form a lake 18 miles long and 5 miles wide. It is now known as Reelfoot Lake and is a tourist and recreation area. Ground failure and landslides were apparent throughout the bluffs (Chickasaw Bluffs) alongside the Mississippi River in Kentucky and Tennessee. Many fissures were made throughout the region, and one local observer recorded that the earth seemed to be rolling in waves a few feet in height. These swells would burst, leaving wide and long fissures. The damage to the area was so severe that Congress passed, and President James Madison signed into law, the first disaster relief act, giving government lands in other territories to people wanting to move out of the area.

During the past decade, an earthquake of 3.1 Richter magnitude occurred on March 31, 1993, close to the Cooper Nuclear Power Station in Brownville, Nebraska. No damages resulted, but the earthquake was felt across the Missouri River near Rock Port, Missouri.

#### **Measure Of Probability And Severity**

The Center for Earthquake Research and Information at the University of Memphis has computed conditional probabilities of a magnitude 6.0 (Richter) earthquake in the New Madrid fault zone. According to a fact sheet prepared by State Emergency Management Agency (SEMA) in 2003, the probability for a magnitude 6.0 to 7.5 or greater earthquake along the New Madrid Fault is 25 to 40 percent over the next 50 years. With approximately 12.5 million people living in the area, steps are being taken to reduce related hazards to citizens and property in the area. The probability of an earthquake increases with each day, which makes it difficult to rate. Based on the information from the Center for Earthquake Research and Information (University of Memphis), the probability of an earthquake is rated as moderate, and the severity is rated as high.

#### **Impact Of The Hazard**

The impacts of earthquakes on Missouri can be significant. The three New Madrid earthquakes of 1811-1812 may be the largest that have happened on the North American continent. Although losses were limited because of the sparse population of the time, many Native Americans died and property was damaged to the point that resettlement became a national policy.



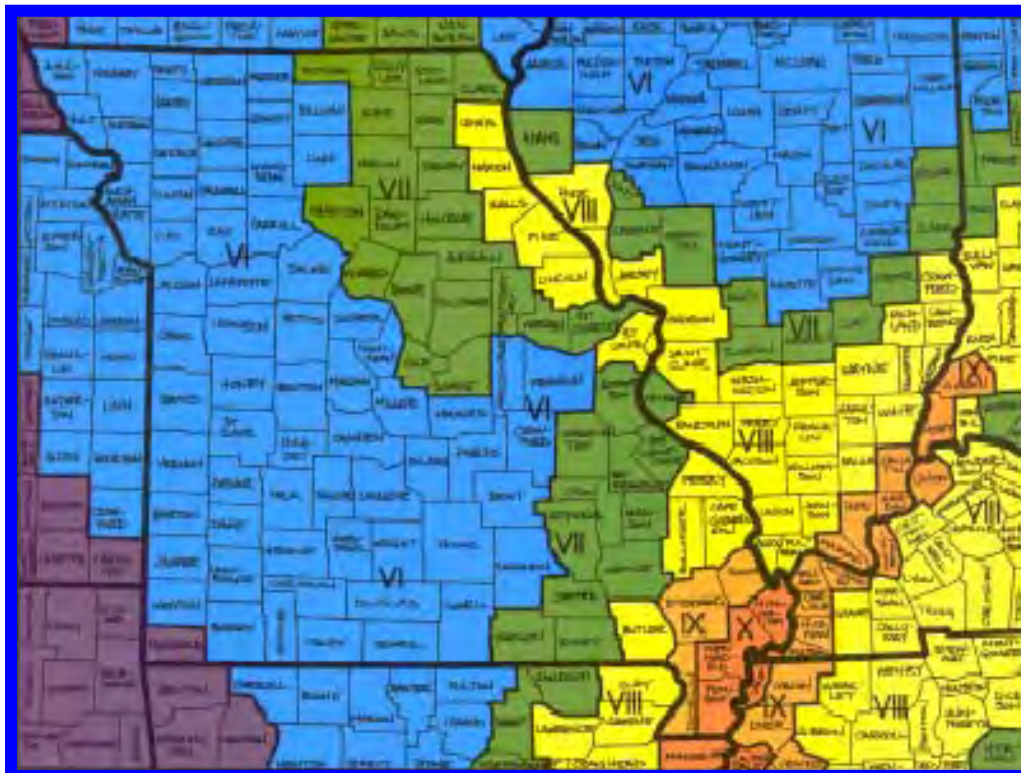
Several studies indicate the need to prepare for earthquakes, as scholars estimate that the New Madrid Fault has the capability of generating Mercalli intensities of X (ten) in Southeast Missouri. The late Dr. Otto Nuttli of St. Louis University stated in his book, “The Effects of Earthquakes in the Central United States,” that surface-wave magnitudes of 7.6 (Richter) would create the largest possible earthquake that could occur anywhere along the New Madrid fault in the near future. Information on preparedness and predictions related to the New Madrid Fault is provided on the U. S. Geological Survey Earthquake Hazards Program website: [www.usgs.gov/hazards](http://www.usgs.gov/hazards), and the Center for Earthquake Research and Information website: [www.ceri.memphis.edu/usgs](http://www.ceri.memphis.edu/usgs).

### **Synopsis**

The chances of an earthquake increase each day. Energy from the movement of the North American tectonic plate continues to build up along both the New Madrid and Nemaha Faults and their subsidiary fault systems. The state will have an earthquake. We don't know exactly where or when, but we are overdue for a moderate earthquake. The earthquakes may affect the citizens of Missouri and surrounding states. Earthquakes also have secondary effects such as fires, building collapses, utility disruptions, flooding, hazardous materials releases, environmental impacts, and economic disruptions or losses.

**Figure 20** shows the highest projected Modified Mercalli Intensities by county from a potential magnitude 7.6 earthquake, for which the epicenter could be anywhere along the length of the New Madrid seismic zone. **Figure 21** describes the projected earthquake intensities V through X based on the Modified Mercalli Intensity Scale.

**Figure 20. Projected Earthquake Intensities (7.6)**



**Figure 21. Modified Mercalli Intensity Scale**

<b>MODIFIED MERCALLI INTENSITY SCALE</b>	
I	People do not feel any Earth movement.
II	A few people might notice movement.
III	Many people indoors feel movement. Hanging objects swing.
IV	Most people indoors feel movement. Dishes, windows, and doors rattle. Walls and frames of structures creak. Liquids in open vessels are slightly disturbed. Parked cars rock.
V	Almost everyone feels movement. Most people are awakened. Doors swing open or closed. Dishes are broken. Pictures on the wall move. Windows crack in some cases. Small objects move or are turned over. Liquids might spill out of open containers.
VI	Everyone feels movement. Poorly built buildings are damaged slightly. Considerable quantities of dishes and glassware, and some windows are broken. People have trouble walking. Pictures fall off walls. Objects fall from shelves. Plaster in walls might crack. Some furniture is overturned. Small bells in churches, chapels and schools ring.
VII	People have difficulty standing. Considerable damage in poorly built or badly designed buildings, adobe houses, old walls, spires and others. Damage is slight to moderate in well-built buildings. Numerous windows are broken. Weak chimneys break at roof lines. Cornices from towers and high buildings fall. Loose bricks fall from buildings. Heavy furniture is overturned and damaged. Some sand and gravel stream banks cave in.
VIII	Drivers have trouble steering. Poorly built structures suffer severe damage. Ordinary substantial buildings partially collapse. Damage slight in structures especially built to withstand earthquakes. Tree branches break. Houses not bolted down might shift on their foundations. Tall structures such as towers and chimneys might twist and fall. Temporary or permanent changes in springs and wells. Sand and mud is ejected in small amounts.
IX	Most buildings suffer damage. Houses that are not bolted down move off their foundations. Some underground pipes are broken. The ground cracks conspicuously. Reservoirs suffer severe damage.
X	Well-built wooden structures are severely damaged and some destroyed. Most masonry and frame structures are destroyed, including their foundations. Some bridges are destroyed. Dams are seriously damaged. Large landslides occur. Water is thrown on the banks of canals, rivers, and lakes. Railroad tracks are bent slightly. Cracks are opened in cement pavements and asphalt road surfaces.
XI	Few if any masonry structures remain standing. Large, well-built bridges are destroyed. Wood frame structures are severely damaged, especially near epicenters. Buried pipelines are rendered completely useless. Railroad tracks are badly bent. Water mixed with sand, and mud is ejected in large amounts.
XII	Damage is total, and nearly all works of construction are damaged greatly or destroyed. Objects are thrown into the air. The ground moves in waves or ripples. Large amounts of rock may move. Lakes are dammed, waterfalls formed and rivers are deflected.

**Table 14** shows the moderate and large earthquakes that have occurred in the Central United States from 1811 to 2001.

**Table 14. Moderate/Large Earthquakes In The Central United States**

Date	Locality	Area Miles	Intensity	Source Zone
Dec. 16, 1811	New Madrid, Missouri	2,000,000	XII	New Madrid Fault
Jan. 23, 1812	New Madrid, Missouri	2,000,000	XII	New Madrid Fault
Feb. 7, 1812	New Madrid, Missouri	2,000,000	XII	New Madrid Fault
June 9, 1838	Southern Illinois	Widespread	VI	Illinois Basin
Jan. 4, 1843	Western Tennessee	40,000	VIII	New Madrid Fault
Unknown, 1860	Central Minnesota	Unknown	Unknown	Colorado Lineament
Aug. 17, 1865	Southeastern Missouri	24,000	VII	New Madrid Fault
April 24, 1867	Lawrence, Kansas	300,000	VII	Nemaha Uplift
June 18, 1875	Western Ohio	40,000	VII	Cincinnati Arch
Nov. 15, 1877	Eastern Nebraska	140,000	VII	Nemaha Uplift
Oct. 22, 1882	Arkansas - Texas	135,000	VI - VII	Ouchita - Wichita Fault
July 26, 1891	Illinois - Indiana	Unknown	VI	Wabash Valley Fault
Oct. 31, 1895	Charleston, Missouri	1,000,000	VIII	New Madrid Fault
May 26, 1909	Illinois	500,000	VII	Cincinnati Arch
April 9, 1917	Eastern Missouri	200,000	VI	St. Francois Uplift
March 8, 1937	Western Ohio	150,000	VII - VIII	Cincinnati Arch
April 9, 1952	Enid, Oklahoma	140,000	VII	Nemaha Uplift
Nov. 9, 1968	South Central Illinois	580,000	VII	Wabash Valley Fault
March 24, 1976	Marked Tree, Arkansas	115,000	V - VI	New Madrid Fault
July 27, 1980	North Central Kentucky	375,000	VII	Cincinnati Arch
Jan. 31, 1986	Anna, Ohio	440,000	VI	Cincinnati Arch
June 9, 1987	Lawrenceville, Illinois	125,000	V - VI	Wabash Valley Fault
Sept. 26, 1990	Chaffee, Missouri	140,000	IV - V	New Madrid Fault
May 3, 1991	Risco, Missouri	150,000	IV - V	New Madrid Fault
Dec. 7, 2001	Evansville, Indiana	24,000	IV - V	Wabash Valley Fault
May 4, 2001	Conway, Arkansas	36,000 est.	III - IV	Ouchita - Wichita Fault

### 3.2.6 Fires (Structural, Urban and Wild)

#### Historical Statistics

Because buildings exist anywhere people live and work, fires can occur at anytime and anyplace throughout the state. The frequency of structural fires depends on a wide range of factors, including, but not limited to population or building density, building use, lack of fire codes, lack of enforcement when fire codes exist, fire safety practices (or lack thereof) by building occupants, lack of adequately equipped fire departments, and criminal intent related to arson.

Data on the frequency of structural fires is included in the Missouri Fire Incident Reporting System Statistics (MFIRS) data provided by the MDFS. However, according to the MDFS, only 384 of approximately 900 fire departments have reported data used in the MFIRS. For this reason, definitive conclusions are not possible; but, fire departments, law enforcement offices and other agencies spend considerable resources responding to and investigating structural fires.

The Forest Division of the MDC is responsible for protecting the privately owned and state-owned forests and grasslands from wildfires. To accomplish this task, eight forestry districts have been established. At the present time, the forestry districts afford intensive fire protection to approximately one-half of the state, or about 16 million acres. Within these districts, fairly accurate forest and grassland fire statistics are available from the MDC. In a typical year, approximately 3,700 wildfires occur. In 2002, 2,376 wildfires occurred in Missouri, burning 54,397 acres. Debris burning (fires resulting from land clearing, burning trash, range, stubble, right-of-way, logging slash, etc.) is the major cause of forest and grass fires in Missouri. Incendiary fires (fires willfully set by anyone on property not owned or controlled by him, and without the consent of the owner) continue to rank second in the number of wildfires that occur each year. See Figure 9 in Section 3.1.6 for a map of the MDC forestry districts.

**Table 15** below lists the number and causes of forest and grassland fires in 2002 and the acres burned. **Table 16** shows the number of fires and acreage burned by forest and grassland fires yearly from 1993 to 2002. In north and west-central Missouri, the MDC has limited firefighting forces. Forestry Division personnel, however, provide training and limited federal excess equipment to the many volunteer rural fire departments.

**Table 15. 2002 Statewide Fires By Cause**

Cause	Number	Acres	% Number	% Acres
Lightening	15	52	0.6 %	0.1 %
Campfire	15	113	0.6 %	0.2 %
Smoking	94	2,181	4.0 %	4.0 %
Debris	1,446	22,801	60.9 %	41.9 %
Arson	349	20,096	14.7 %	36.9 %
Equipment	78	688	3.3 %	1.3 %
Railroad	9	26	0.4 %	0.0 %
Children	19	203	0.8 %	0.4 %
Miscellaneous	237	3,191	10.0 %	5.9 %
No Report	114	5,046	4.8 %	9.3 %
TOTAL	2,376	54,397	100 %	100 %

**Table 16. Statewide Fires And Acres Burned**

Year	Fires	Acres
1993	2,994	31,952
1994	2,748	51,896
1995	2,910	48,907
1996	3,793	88,933
1997	2,487	29,557
1998	1,112	10,415
1999	1,348	18,270
2000	4,910	132,718
2001	2,972	41,092
2002	2,376	54,397

### **Measure Of Probability And Severity**

Even with the limited data in the MFIRS statistics, the probability of structural fires is quite high. Total monetary loss in 2002 according to the MFIRS, was over \$75 million. In addition, there were 40 fire-related deaths in Missouri during 2002. Therefore, severity could be considered moderate. The probability of wildfires (forest, prairie, and grassland) is considered moderate overall, but may increase to high during certain periods such as spring or late fall, or under conditions of excessive heat, dryness, or drought. The severity would be considered low to moderate.

### **Impact Of The Hazard**

Structural and urban fires are a daily occurrence throughout the state. Approximately 100 fatalities occur annually, as well as numerous injuries affecting the lives of the victims, their families, and many others—especially those involved in fire and medical services. Unlike other disasters, structural fires are often insidious and despicable due to the prevalence of arson. All citizens pay the costs of arson whether through increased insurance rates, higher costs to maintain fire and medical services, or the costs of supporting the criminal justice system.

### **Synopsis**

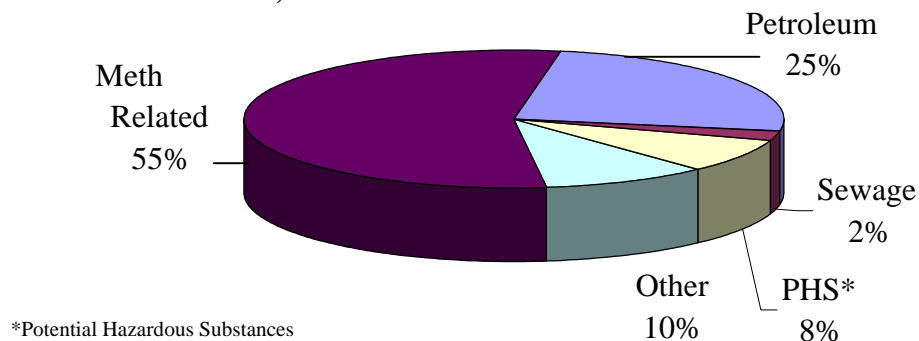
With sufficient mutual aid, local fire services have adequate day-to-day fire service capabilities. The greatest risk of interaction by fires with other hazards may involve damaging earthquakes. In these circumstances, the possibility of numerous fires and reduced firefighting capabilities would greatly increase the severity of structural fires.

## **3.2.7 Hazardous Materials Release (fixed site and transportation accidents)**

### **Historical Statistics**

The MDNR/ALPD Environmental Emergency Response (EER) Section receives most of the environmental emergency response reports in Missouri. All environmental emergencies are to be reported, 24 hours a day, to (573) 634-2436. Approximately 3,879 reports were received by MDNR/EER in calendar year 2002. Of those reports, 2,120 (nearly 55 percent) were related to methamphetamine laboratory or other drug lab activities, and 963 (25 percent) were related to petroleum materials. Also, 320 (8 percent) were potential hazardous substances emergency events (see **Figure 22**).

**Figure 22. Environmental Emergency Response Reports to MDNR/EER by Material Nature (Calendar Year 2002)**



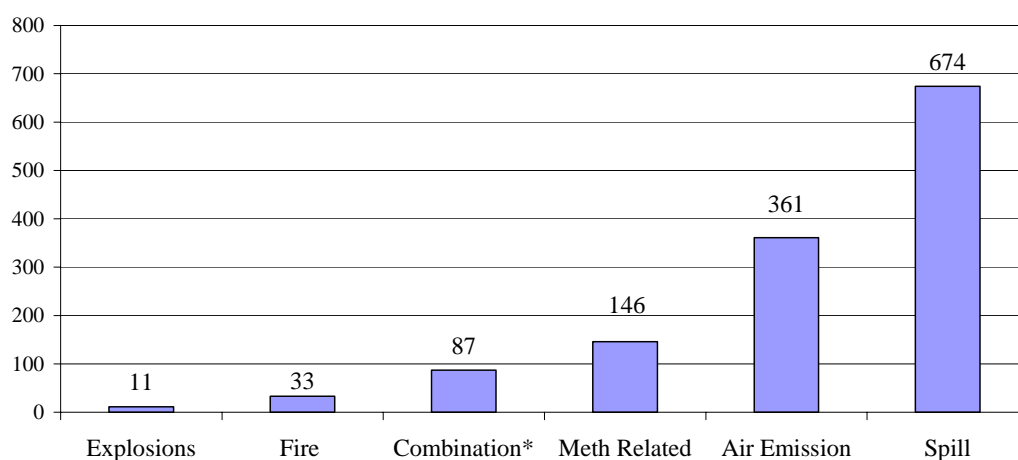


In 2002, 589 potential hazardous substance emergencies were reported to the Missouri HSEES system by the U.S. Coast Guard's National Response Center (NRC). Of these, 75 (13 percent) met the HSEES case criteria and were entered into the HSEES database as events.

MDHSS reported a total of 957 hazardous substance emergency events that met the HSEES case definition during calendar years 1999 to 2001. Of these, two events were threatened releases, four were a combination of actual and threatened releases, and the remainder was actual releases. The statistics reported herein are based primarily on the data from these 1999 to 2001 HSEES events and the associated data analysis report published by MDHSS (available on-line at [www.dhss.state.mo.us/hsees](http://www.dhss.state.mo.us/hsees)). A similar data report, "Methamphetamine Events Analysis, 1999-2001," is also available, providing hazard analysis considerations dedicated solely to the HSEES events that involved methamphetamine-related activities. Of the events considered in the overall HSEES reporting for 1999 to 2001, 146 (15.3 percent of all events) were meth-related, with 122 (83.6 percent) of these occurring at fixed facilities and 24 (16.4 percent) transportation-related.

Types of releases reported were spills, air emissions, fires, explosions, threatened releases, and other non-specified types of releases. Spills were the most common type of release, followed by air emissions and combination releases that involved two or more types of releases (i.e. spill and fire; fire and explosion; or fire and air emission) (see **Figure 23**).

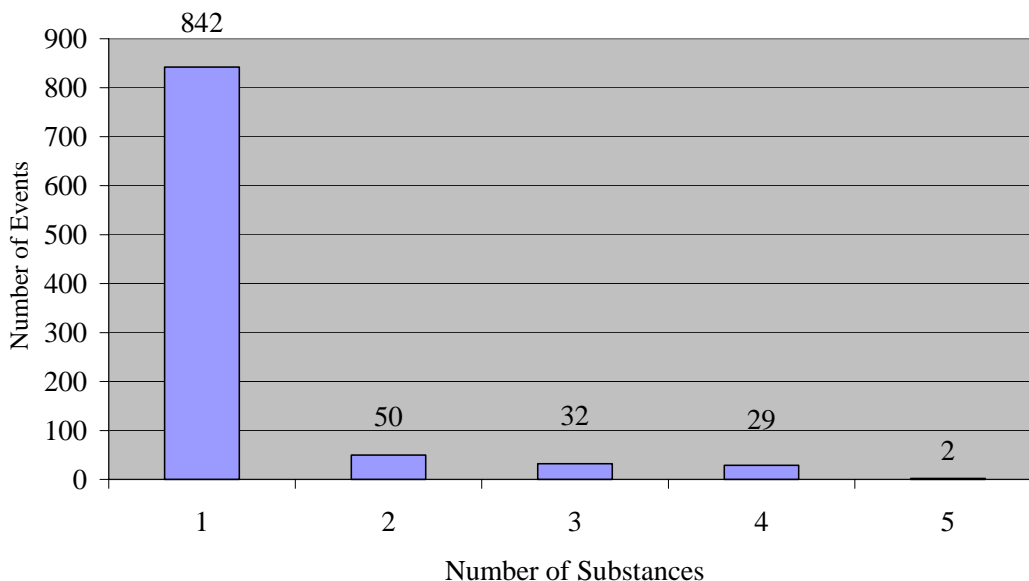
**Figure 23. Types of Releases by Cause, MO HSEES (1999-2001)**



\* Combination = Two or more types of releases, a combination of causes

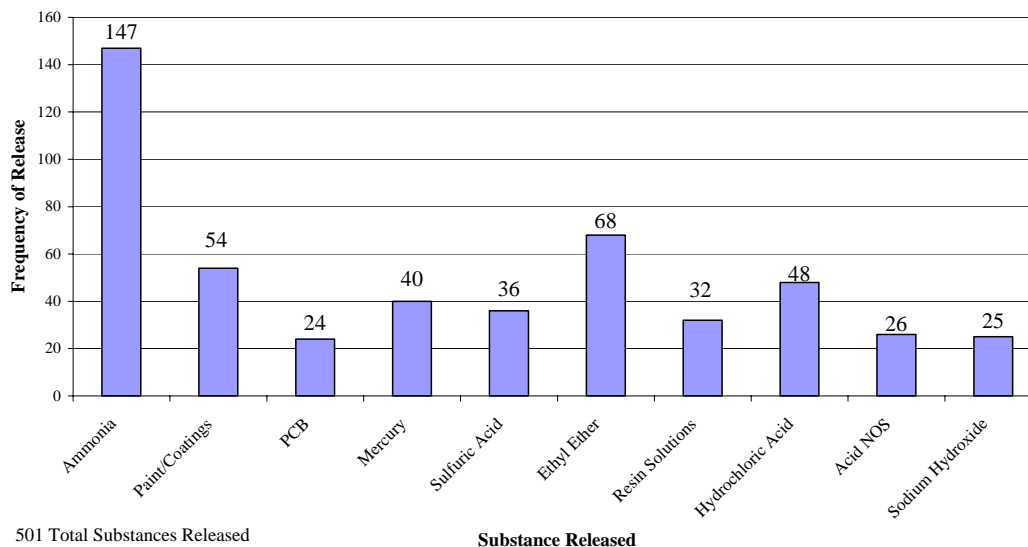
A total of 501 substances were reported as being released. Most of the events (842 or 88 percent) involved the release of only one substance. The highest recorded number of substances released in any single event was five. The most commonly released substance was ammonia, with 147 releases (29.1 percent), followed by ethyl ether with 68 releases (13.6 percent); paint/coating products with 54 releases (10.7 percent); hydrochloric acid with 48 releases (9.6 percent); mercury with 40 releases (8 percent); sulfuric acid with 36 releases (7.2 percent); resin solutions with 32 releases (6.4 percent); and polychlorinated biphenyls (PCBs) with 24 releases (4.8 percent) (see **Figures 24 and 25**).

**Figure 24. Number of Substances Released Per Event, MO HSEES (1999-2001)**



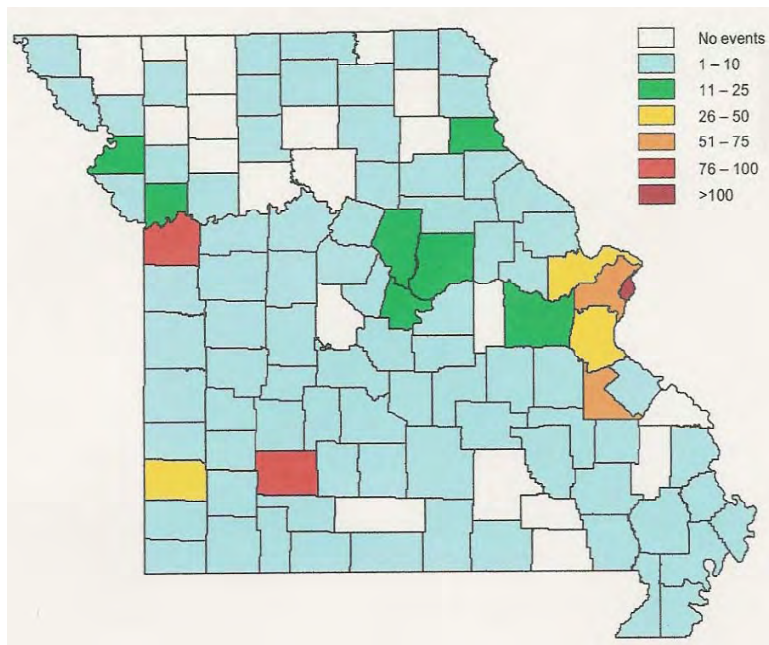
Events occurred throughout the state in 94 counties and the City of St. Louis. This represents over 80 percent of the counties of the state. Most of the events occurred in counties with larger cities, interstate highways, and large manufacturing or mining facilities.

**Figure 25. Most Frequently Released Substances, MO HSEES (1999-2001)**



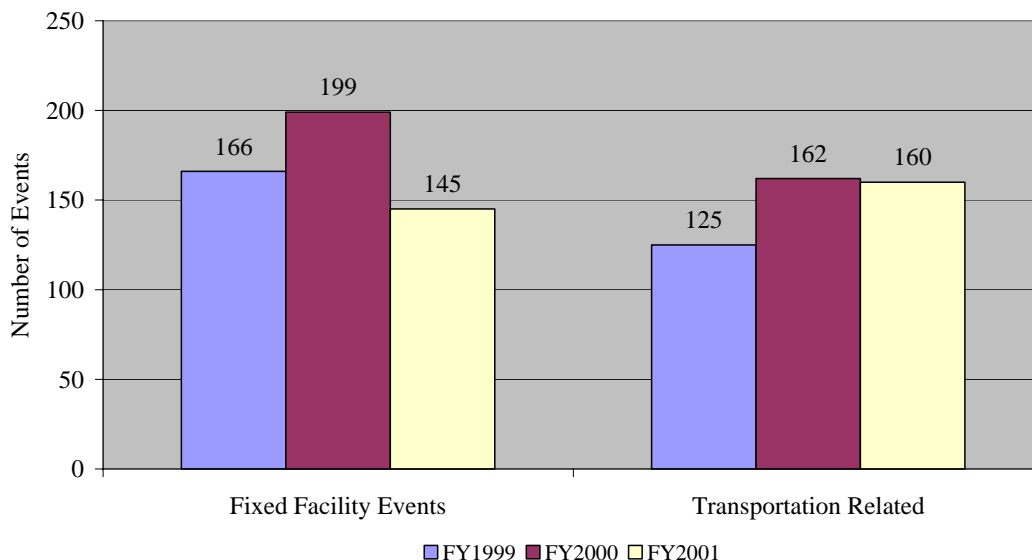
**Figure 26** shows the approximate number of events occurring in each county during calendar years 1999 to 2001.

**Figure 26. Geographic Distribution of Events by County, MO HSEES (1999-2001)**



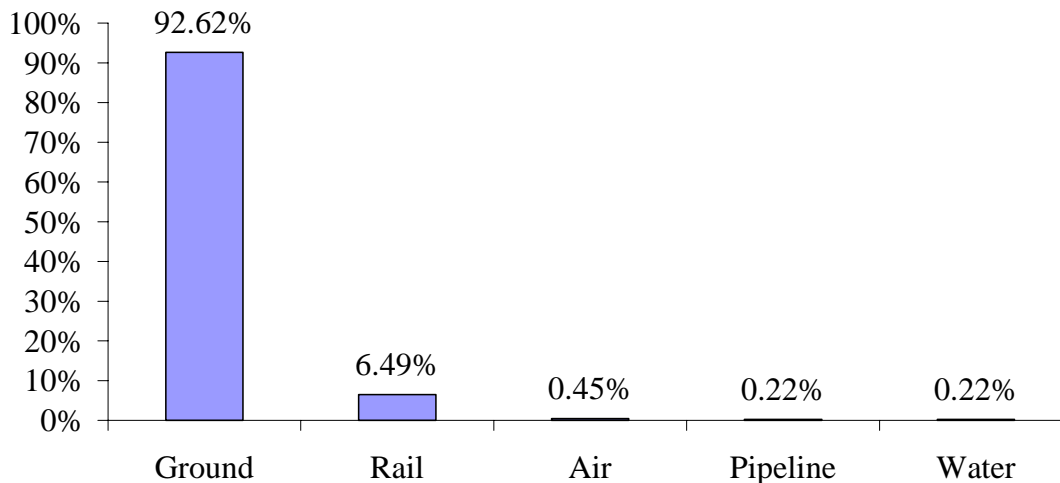
Releases occurring at fixed facilities totals 510 (53.3 percent). Of these, 447 (46.7 percent) were transportation-related releases. Of the 447 transportation-related events, 92.6 percent involved ground transportation (e.g. truck, van, tractor, automobile), and 6.5 percent were rail transportation events (see **Figures 27 and 28**). **Figure 29** summarizes the number of events occurring each month at fixed facilities and as a result of transportation-related events during calendar years 1999 to 2001.

**Figure 27. Events by Type – Fixed Facility vs. Transportation, MO HSEES (1999-2001)**

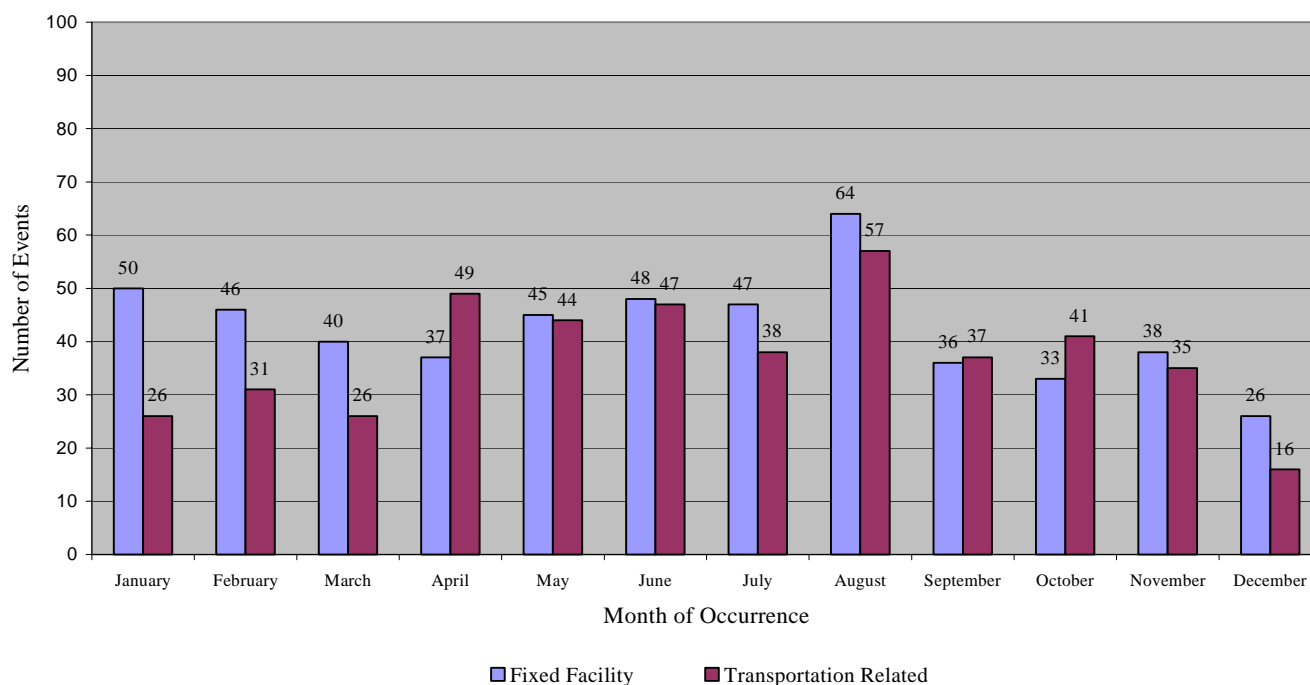




**Figure 28. Distribution of Transportation Related Events by Type of Transportation, MO HSEES (1999-2001)**



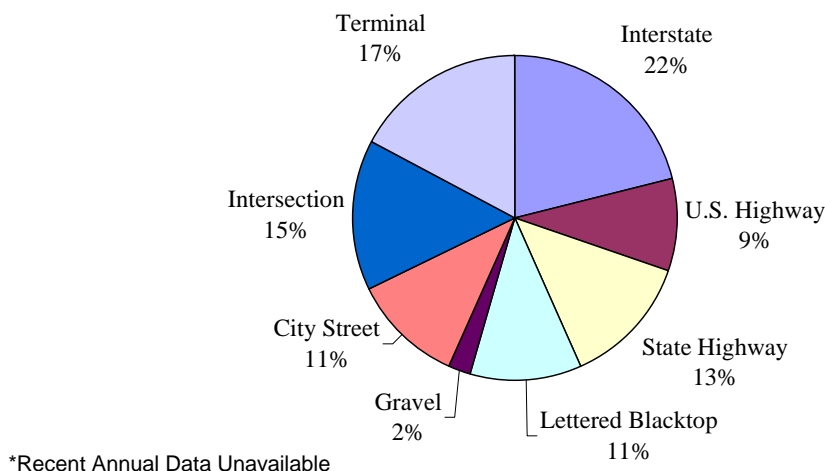
**Figure 29. Events by Month of Occurrence, MO HSEES (1999-2001)**



In Missouri, 39 counties and the City of St. Louis have interstate highways running through them. Because most transportation-related events (over 90 percent) involved ground transportation, a detailed examination of these events is warranted; information is based on 1995 to 1996 data, because more current information was not available from HSEES. Analysis of these incidents has shown that approximately 21 percent occurred on an interstate highway. Further analysis showed that roughly half involved leaking loads or trailers along the side the highway, and half were accident-related incidents. In contrast, 9 percent of the events occurred on U.S. highways, 13 percent occurred on state highways; 11 percent occurred on lettered

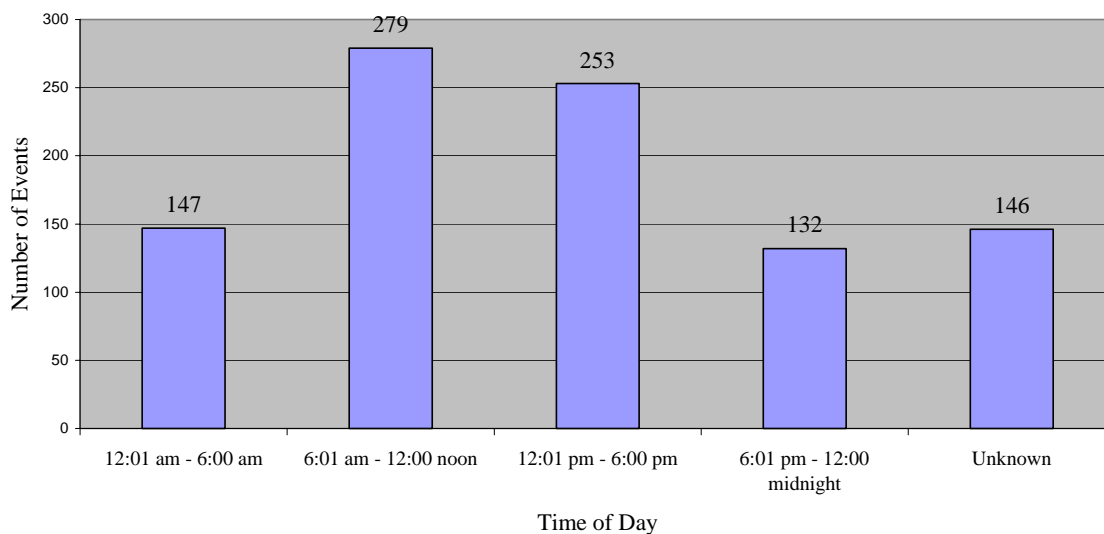
blacktop roadways; 11 percent occurred on city streets; and 1 event (2 percent) occurred on a gravel road. Eight events (15 percent) occurred at the intersection of roads. Of these eight events, five occurred at the intersection of city streets, two occurred at a U.S. highway-lettered blacktop intersection, and one at an interstate-state highway intersection. Nine events (17 percent) occurred at transportation terminals (see **Figure 30**).

**Figure 30. Ground Transportation Events by Location, MO HSEES (1995-1996\*)**

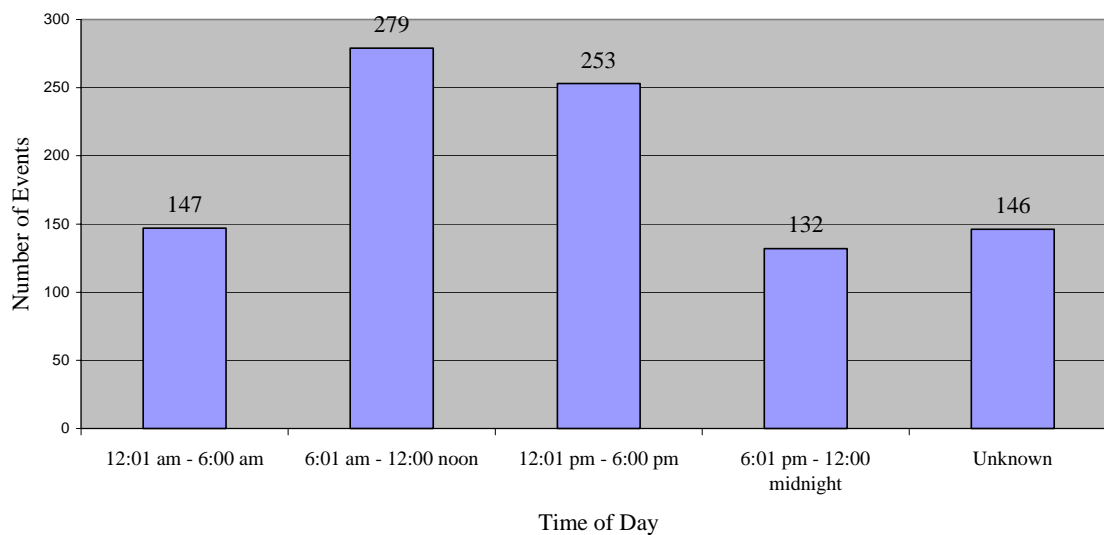


Considering all reported events, approximately 84 percent occurred on weekdays, and 16 percent occurred on the weekend. Over half the events (56 percent) occurred between 6:00 a.m. and 6:00 p.m., the time period encompassing the core working hours of 8 a.m. and 5 p.m., Monday through Friday. Approximately 15 percent occurred between midnight and 6:00 a.m., and 14 percent occurred between 6:00 p.m. and midnight. The time of occurrence was unknown for 146 (15.2 percent) of the 957 reported HSEES events (see **Figures 31 and 32**).

**Figure 31. Events by Day of the Week, MO HSEES (1999-2001)**



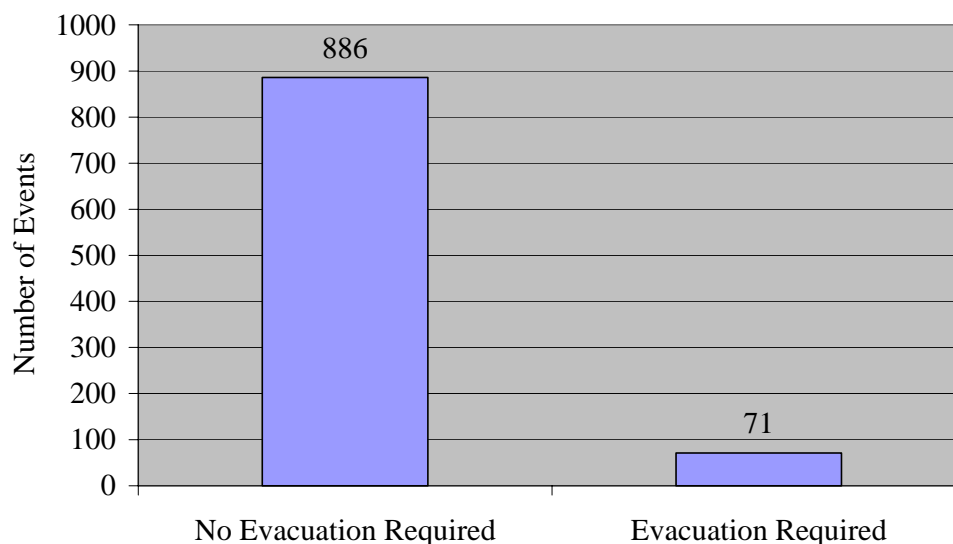
**Figure 32. Events by Time of Day, MO HSEES (1999-2001)**



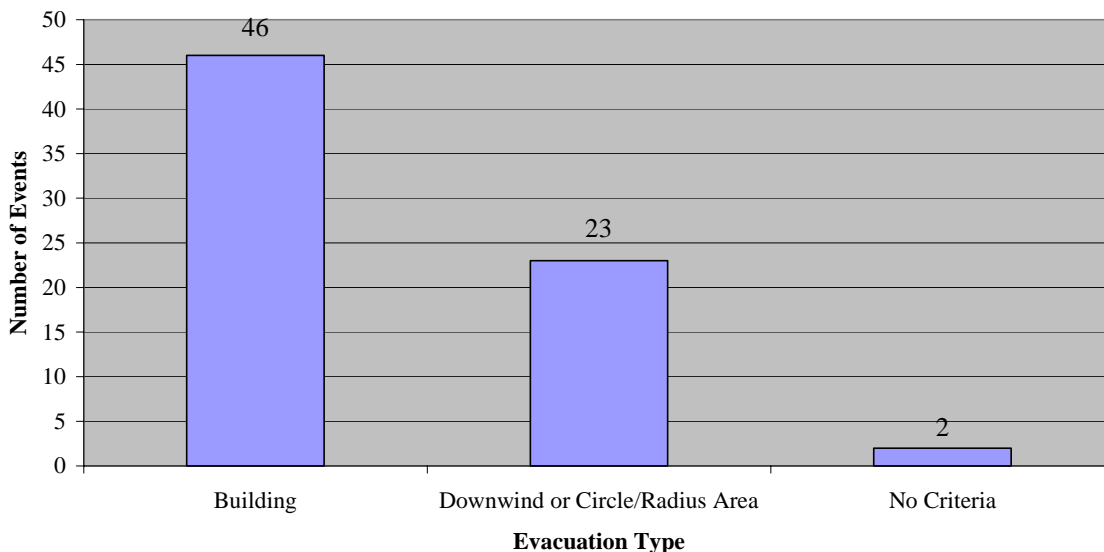
Evacuations were ordered in response to 71 (7.4 percent) of the reported events (see **Figure 33**). The number of people evacuated was known for 65 of these events and unknown for 6 events. The median number of persons evacuated per event was 24 (range was from 1 to 2,500 persons). The length of evacuation was known for 67 of the 71 events, with the median length of evacuation being 4 hours (range was 1 to 168 hours).

**Figure 33. Summary of Events Requiring Evacuation, MO HSEES (1999-2001)**

Forty-six (64.8 percent) of the evacuations involved the affected building(s) or parts of the buildings, 23 (32.4 percent) were downwind or circle/radius area evacuations, and two evacuations (2.8 percent) were reported with no evacuation criteria indicated (see **Figure 34**).

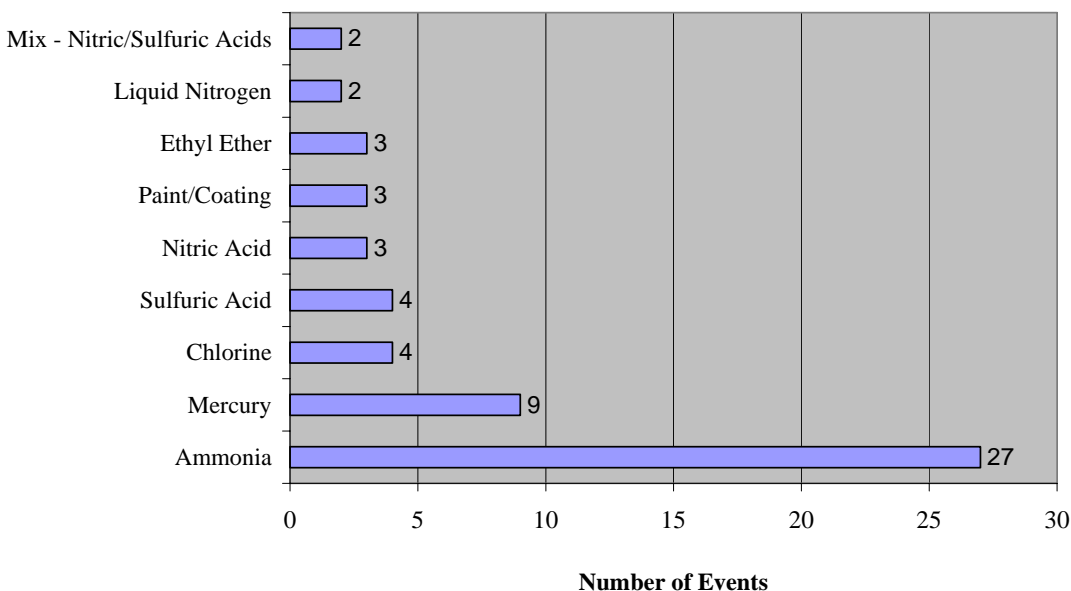


**Figure 34. Events Requiring Evacuation by Type, MO HSEES (1999-2001)**



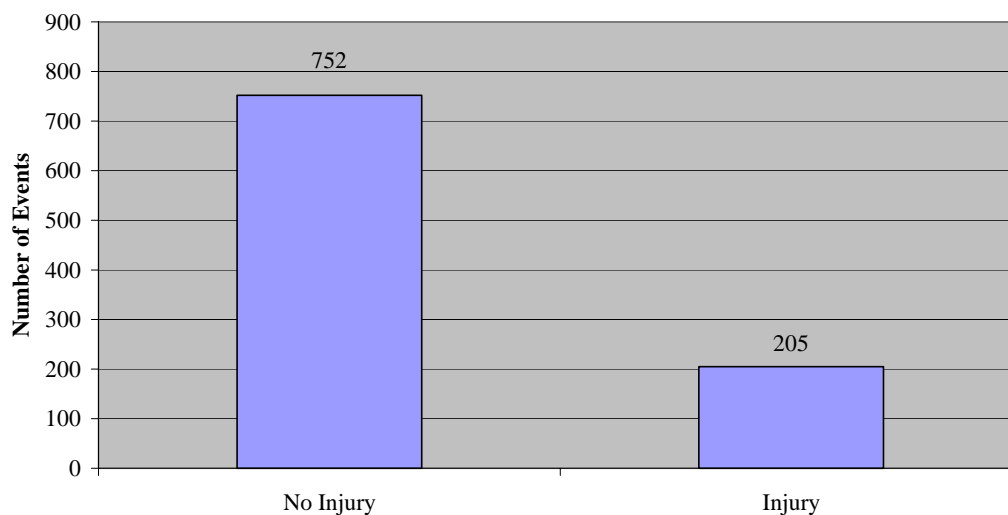
**Figure 35** shows the most commonly released substances related to evacuations. Ammonia was the most commonly released substance requiring evacuation, occurring in 27 events with a total of 1,984 evacuees. Mercury was the second most common substance, with nine events resulting in evacuation of 85 persons. Chlorine was involved in four events with a total of 225 evacuees, and sulfuric acid was involved in four events with a total of 181 evacuees. Of the substances listed on Figure 35, liquid nitrogen resulted in the greatest recorded number of evacuees at 2,500, although it was only involved in two events.

**Figure 35. Most Commonly Released Substances Requiring Evacuations, MO HSEES (1999-2001)**

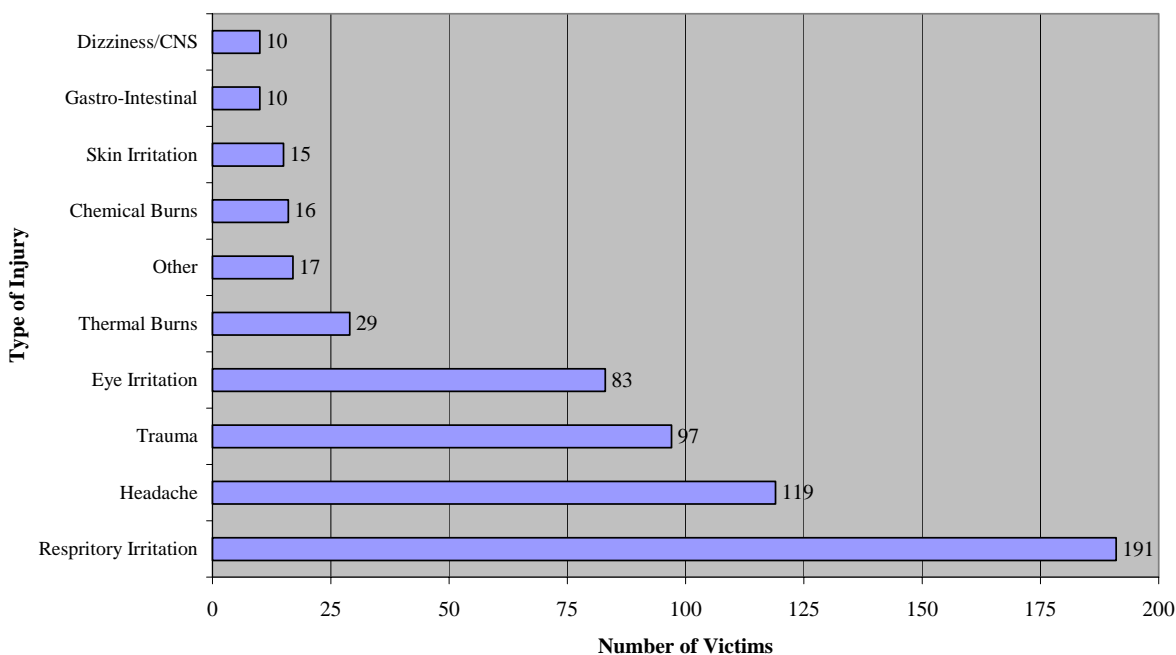


The events resulting in injuries totaled 205 (21.4 percent of all events), with 425 victims. The most common type of injury reported was respiratory irritation, which occurred in 191 (45 percent) of the victims. Other types of injuries or symptoms included eye irritation, chemical burns, thermal burns, skin irritation, dizziness or central nervous system (CNS) effects, nausea or vomiting, and trauma (see **Figures 36 and 37**).

**Figure 36. Summary of Events with Injuries, MO HSEES (1999-2001)**



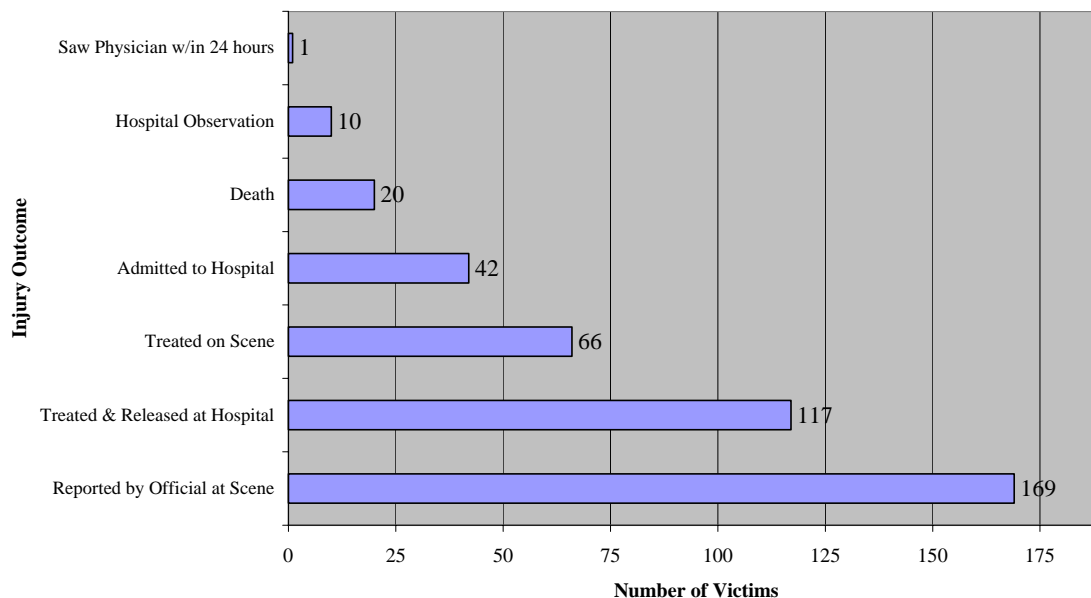
**Figure 37. Types of Injuries from MO HSEES Events (1999-2001)**



Of the 425 victims, 20 deaths were reported, 66 were treated at the scene, 117 were treated at a hospital but not admitted, and 42 were admitted to a hospital (see **Figure 38**). Injuries reported

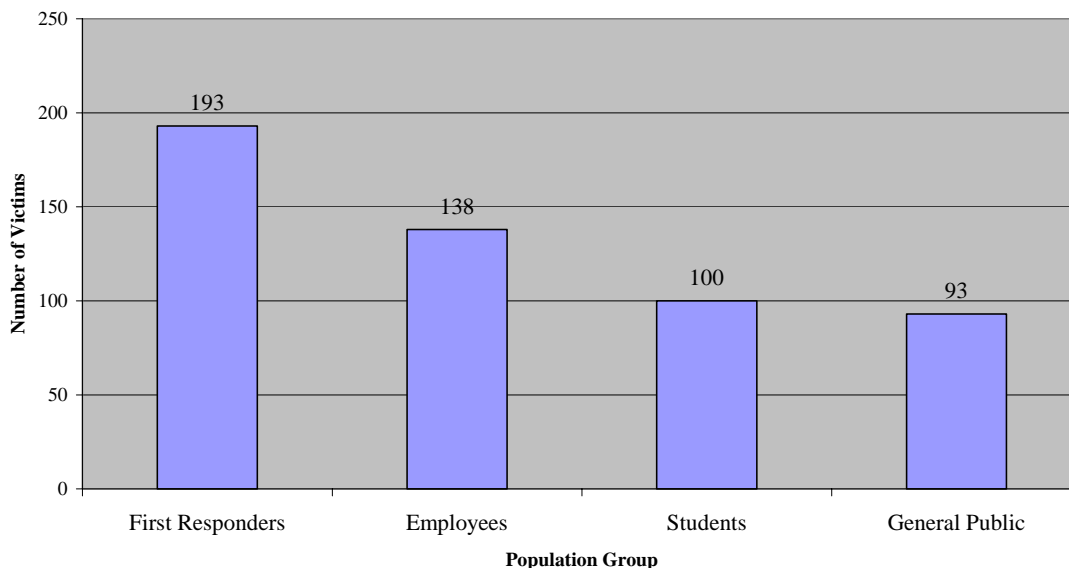
by an official at the scene was the most frequent injury outcome with 169 reports (39.8 percent), most of these injuries were self-reported by law enforcement officials responding to or collecting evidence from clandestine methamphetamine laboratories. The remaining reported victims were either seen for observation at a hospital or seen a physician within 24 hours.

**Figure 38. Injury Outcome from MO HSEES Events (1999-2001)**



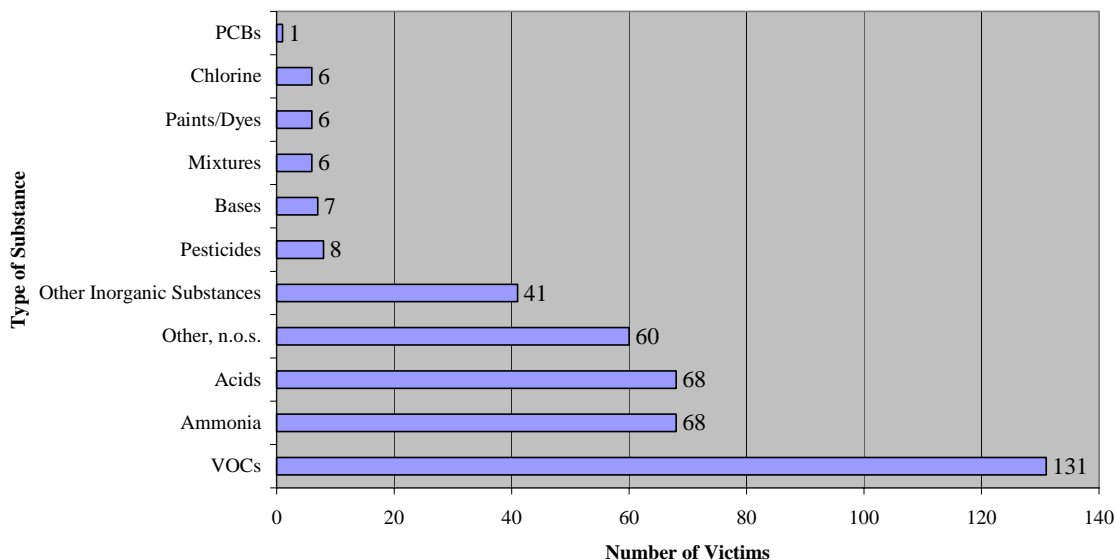
One hundred thirty-eight employees, 193 responders, 93 members of the general public, and 100 students were recorded among the injury reports (see **Figure 39**).

**Figure 39. Victims by Population Group, MO HSEES (1999-2001)**



Volatile organic compounds (VOCs) were the most common category of substances released and involved 131 reported victims with symptoms (32.6 percent of releases with victims). Ammonia and acids were the second most common substances released, resulting in 68 reported victims each (16.9 percent of releases with victims each). Other categories of commonly released substances that resulted in victims include pesticides, bases, chlorine, paints and dyes, and mixtures of substances, with each of these categories resulting in 2 percent or less of the total reported victims (see **Figure 40**).

**Figure 40. Victims by Substances Released, MO HSEES (1999-2001)**



## **Measure Of Probability And Severity**

### **Hazardous Materials Transportation Accident**

The probability of occurrence is rated as high because of the large volume of hazardous materials being hauled over the highways and railways. This rating means that the probability of occurrence is considered sufficiently high as to assume that an event will occur at least once within any mode of transportation (including water, pipeline, and air) during a 3- year HSEES reporting period (See earlier Figure 29).

The severity of the consequences is rated as moderate, but may be either low or high depending on the location of the accident and the time of day. This rating means injuries and/or death are expected only for exposed personnel over extended periods of time or when individual personal health conditions create complications.

### **Hazardous Materials Fixed Facility Accident**

The probability of occurrence is rated as moderate. With the new regulations from EPA and OSHA, along with more stringent state laws and employee awareness training, this rating may be lowered to low or raised to high based on past performance. This rating means the probability of occurrence is possible during the expected lifetime of the facility.

The severity of consequences is rated as moderate but may be either low or high depending on the type and amount of chemical released. This means the chemical is expected to move into the surrounding environment at a concentration sufficient to cause serious injuries and/or death, unless prompt and effective corrective actions are taken. Injuries and/or death would be expected only for personnel exposed over an extended period or when individual personal health conditions create complications.

Note: The severity to the environment will vary in every case depending on the amount, type, and method released to determine the damage to property and the environment. Close coordination between the Missouri Department of Natural Resources, EPA, the local jurisdiction, and the spiller (responsible party) is required to ensure that potential impacts to public health and the environment are adequately addressed.

### **Impact Of The Hazard**

The entire State of Missouri is susceptible to this type of hazard, depending on a number of factors such as the following:

- Type of chemical
- Amount released/spilled
- Method of release
- Location of release
- Time of day
- Weather conditions.

This hazard could have a significant impact on the public health, the environment, or private property.

The impact of this type of disaster will likely be localized to the immediate area surrounding the incident. The initial concern will be for the people, then the environment. If contamination occurs, then the spiller is responsible for the cleanup actions and will work closely with the Missouri Department of Natural Resources, EPA, and the local jurisdiction to ensure that cleanup is done safely and in accordance with federal and state laws.

Local government (county or municipal) is more often directly impacted by radiological incidents than state or federal government. Local responders are generally the first on scene for any incident. Therefore, they have the responsibility for treating any injured victims and transporting them to a hospital for more complete medical care. Also, local first responders have the initial responsibility for controlling exposure of emergency workers and the public to any radioactive materials and to contain the spread of radioactive contamination as much as possible. While cleanup of any actual spill of radioactive materials rests with the shipper (in most cases), local responders may be required to provide site control for several hours until the responsible parties arrive on the scene.

A past survey was completed of Missouri fire departments across the state, asking their perception of their own capabilities to respond to a radiological incident. Of the 433 departments



surveyed, only 118 responded. Of those, 21 believed they could adequately handle a radiological incident until proper authorities arrive.

This indicates that pockets of adequate radiological response capabilities are available throughout the state. However, the main transportation corridors have some gaps. It is also clear that more training needs to be encouraged along these corridors. The same consideration must be given to any county located under commercial flyways or where it might be possible for a fallen satellite to leave a contaminated "footprint" (COSMOS 954 left a 200-mile footprint in the Northwest Territory of Canada in 1978).

With current federal grants and programs in place to provide funding for training, exercises, and equipment for state and local response to an act of terrorism and weapons of mass destruction (WMD), the general capabilities of hazardous materials response personnel and teams statewide to respond to a hazardous materials incident is expected to improve. Refer to Section 3.1.15 – Terrorism, of this State Hazard Analysis for more information on this topic.

### **Synopsis**

Any disaster or emergency incident could result in additional concerns when it involves of hazardous materials. For example, during the floods of 1993, a large propane tank farm in St. Louis was threatened by rising floodwaters, forcing evacuations of nearby residents in several areas. Another hazardous materials incident related to the 1993 floods involved an on-going ammonia release from the La Roche Industries, Inc., facility near Crystal City, Missouri, caused by power failure and failure of the cooling system on a large ammonia tank, ultimately resulting in off-gassing of ammonia through the tank's pressure relief check valves. The ammonia cloud over the plant led to a declaration of restricted air space in the plant vicinity for several days.

In addition, thousands of chemical containers ranging from household products and 55-gallon drums to 10,000-gallon fuel storage tanks were displaced statewide as a result of the flood damage. A federal disaster declaration was issued, the Federal Response Plan (FRP) was implemented, and the Emergency Support Function (ESF) #10 – Hazardous Materials Annex was activated to support the statewide response to hazardous materials incidents like these and others that resulted from the flooding.

Each emergency event will need to be evaluated on an incident-specific basis, and top priority must be given to the protection of the public, then the environment, and finally property.

### **Maps Or Other Attachments**

Tier II Forms are filed and maintained by the Missouri Emergency Response Commission (MERC) at SEMA. Site-specific plans are on file with each county's Local Emergency Planning Commission (LEPC). Transportation and evacuation routes are identified in each county emergency operations plan.

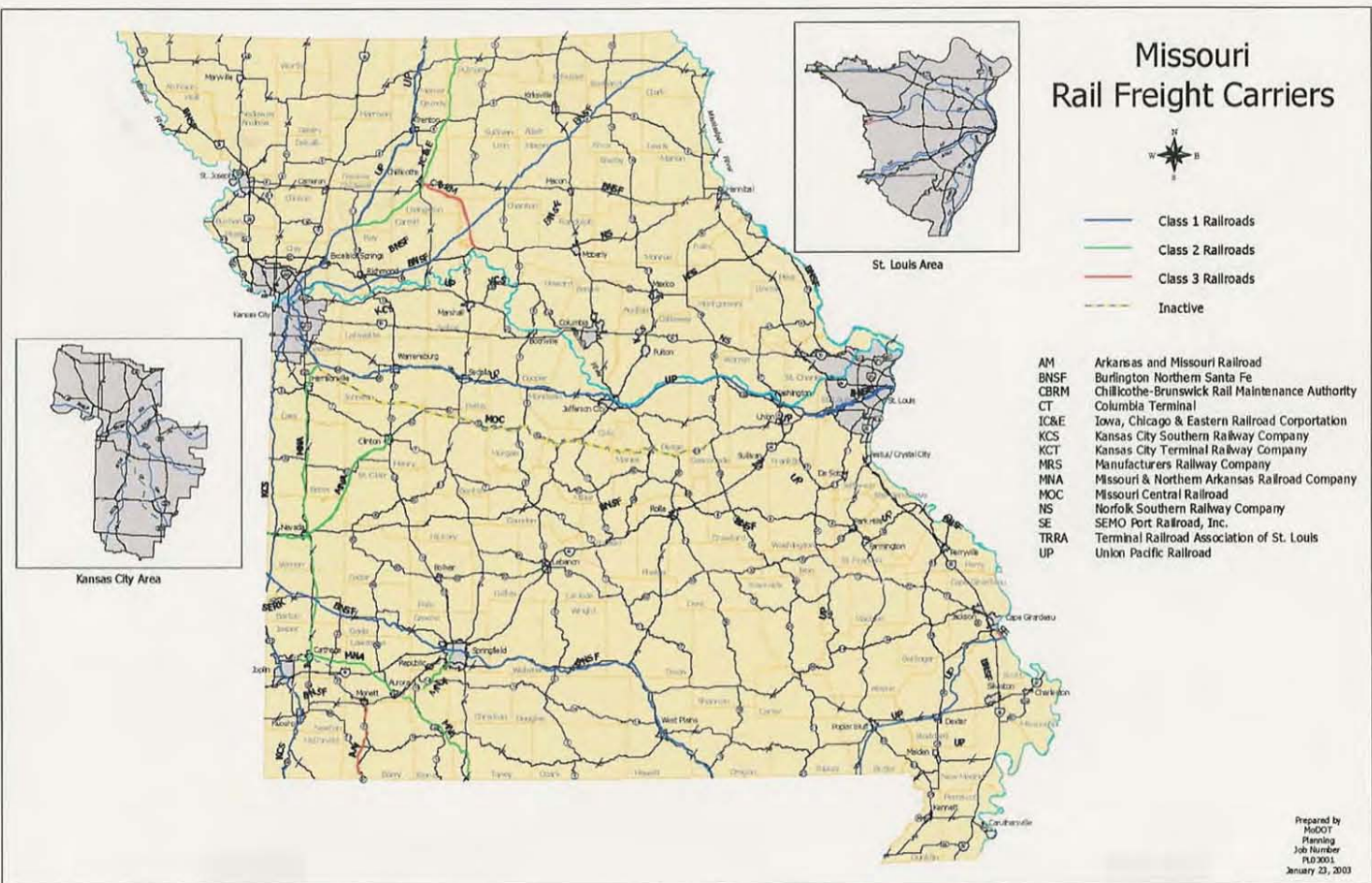
See Section 3.2.17 for a map of Missouri pipelines.

The SEMA Homeland Security Response Teams Map, included in Section 3.2.15, indicates 28 existing or proposed Homeland Security Response Teams for the State of Missouri. A few of

these teams include hazardous materials response teams with enhanced capabilities for response to WMD incidents, including incidents involving nuclear or radiological materials, biological agents, and chemical agents. The SEMA Terrorism Program should be contacted to determine the capabilities of these Homeland Security Response Teams in specific areas.

Attachments to this section include the following: Map of Missouri HSEES Events by County, 1999 to 2001 (see earlier Figure 26), the MO HSEES 1999 to 2001 Data Analysis Report Charts (see earlier Figures 22 through 25, and Figures 27 through 40), and the Missouri Rail Freight Carriers System Map (see **Figure 41**).

Figure 41 Missouri Rail Freight Carriers System Map

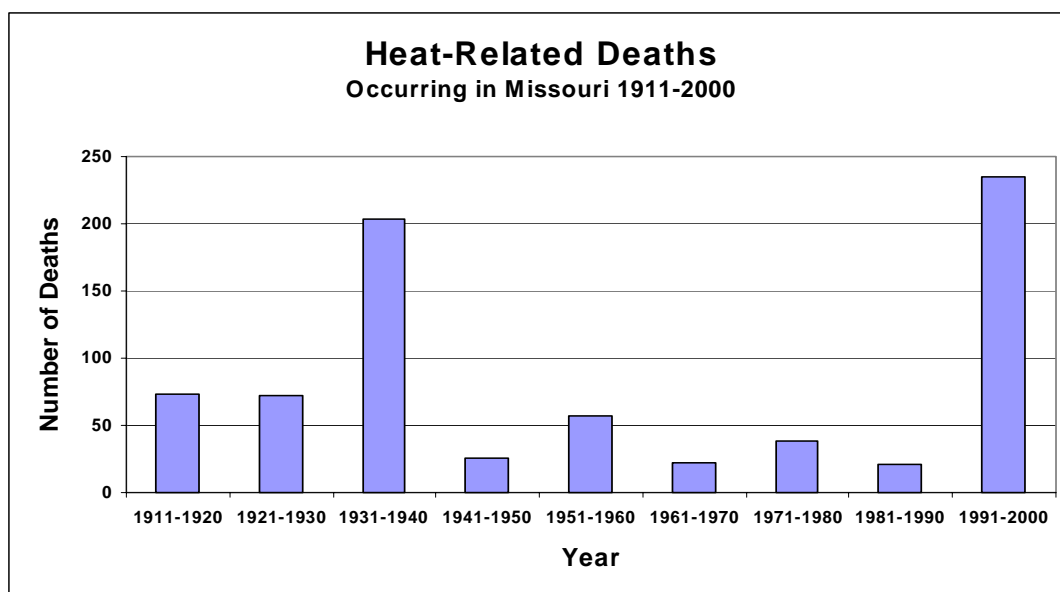


### 3.2.8 Heat Wave

#### Historical Statistics

Heat kills by taxing the human body beyond its abilities. In a normal year, approximately 175 Americans succumb to summer heat. In a 40-year period, 1936 through 1975, nearly 20,000 people died in the United States from the effects of heat and solar radiation. Over the past nine decades, the Missouri State Department of Health has compiled statistics for deaths from excessive heat. **Figure 42** depicts the number of deaths in Missouri from 1911 to 2000. In 2001, it was reported that 47 Missourians died due to heat-related causes. In 2002, 24 persons died in Missouri due to heat. In United States, some of the worst years for heat-related deaths occurred during the Great Depression, with 843 deaths in 1934, and 644 in 1936. The worst year in the past few decades was 1980, with 1,250 deaths from excessive heat.

**Figure 42. Heat Related Deaths in Missouri (1911-2000)**



#### Measure Of Probability And Severity

Based on 30-year statistics from the NWS indicating the state's mean number of days above 90°F, Missouri is vulnerable to heat waves ranging from high to moderate risk in July and August. The NWS has developed a Heat Index/Heat Disorder Chart that relates ranges of HI with specific disorders, particularly for people in higher risk groups (see **Table 17**).

**Table 17. Heat Index/Heat Disorder Chart**

Heat Index	Heat Disorder
130°F or higher	Heat stroke or sunstroke likely with continued exposure
105 to 129°F	Sunstroke, heat cramps, or heat exhaustion likely, and heat stroke possible with prolonged exposure or physical activity
90 to 104° F	Sunstroke, heat cramps, and heat exhaustion possible with prolonged exposure or physical activity
80 to 89°F	Fatigue possible with prolonged exposure or physical activity

**Table 18** shows the three response levels developed by the NWS, based on the Heat Index, to alert the public to the potential heat hazards:

**Table 18. Heat Index and Response Levels**

Heat Index	Response Level
130°F or higher	Warning
105 to 129°F	Watch
90 to 104°F	Advisory

Based on information from the Department of Health and Senior Services and the NWS, the State rates the probability of a heat wave as moderate and severity as moderate, but the probability could be upgraded to severe.

The Missouri Department of Health and Senior Services will announce a statewide hot weather health alert (see **Table 19**), when the conditions are as follows:

**Table 19. Type and Conditions of Hot Weather Alerts**

Type of Alert	Conditions of Alert
Hot Weather Health Alert	Heat indices of 105°F in a large portion of the state are first reached (or predicted).
Hot Weather Health Warning	Heat indices have been 105°F or more for 2 days in a large portion of the state; or weather forecasts call for continued heat stress conditions for at least 24 to 48 hours, over a large portion of the state.
Hot Weather Health Emergency	When extensive areas of the state meet the following criteria: (1) High sustained level of heat stress (HI 105 °F for 3 days), (2) Increased numbers of heat-related illnesses and deaths statewide, and (3) The NWS predicts hot, humid temperatures for the next several days for a large portion of the state.

### **Impact Of The Hazard**

The severity of heat disorders tends to increase with age. Heat cramps in a 17-year-old can become heat exhaustion for someone in their forties, and may result in a fatal stroke for someone in their sixties. **Table 20** lists conditions associated with heat, their symptoms and suggested first aid.

**Table 20. Heat Disorder Symptoms and First Aid**

Heat Disorder	Symptoms	First Aid
Sunburn	Redness and pain. In severe cases, swelling of skin, blisters, fever, and headaches.	Apply ointment for mild cases if blisters appear. If breaking occurs, apply dry sterile dressing. Serious, extensive cases should be seen by physician.
Heat Cramps	Painful spasms possible usually in muscles of legs and abdomen. Heavy sweating.	Apply firm pressure on cramping muscles, or gentle massage to relieve spasms. Give sips of water.

Heat Disorder	Symptoms	First Aid
Heat Exhaustion	Heavy sweating and weakness; cold, pale and clammy skin. Pulse thready. Normal temperature possible. Fainting and vomiting.	Get victim out of sun. Lie down and loosen clothing. Apply cool wet cloths. Fan or move victim to air conditioned room. Give sips of water. If vomiting continues, seek immediate medical attention.
Heat Stroke (or Sunstroke)	High body temperature (106 °F, or higher). Hot dry skin. Rapid and strong pulse. Possible unconsciousness.	Heat stroke is a severe medical emergency. Summon medical assistance or get the victim to a hospital immediately. Delay can be fatal. Move the victim to cooler environment. Reduce body temperature with cold bath or sponging. Use extreme caution. Remove clothing. Use fans and air conditioners. If temperature rises again, repeat process. Do not give fluids.

The following population groups are at a greater risk to becoming very sick from heat waves:

**Those Vulnerable To Heat Stress Due To Physical Condition**

- Older people
- Children
- People overweight or underweight

**People With Limited Independence Due To Physical or Mental Disorders**

- People in institutional settings without air conditioning
- People working in heat under stress (firefighters, police, emergency medical technicians)
- People in urban environments where heat retention in asphalt, concrete and masonry is a factor (heat island effect)
- People with low income who lack resources for air conditioning, transportation, medical care, etc.

**Those With Increased Risk From Work or Leisure Activities**

- People who work outdoors (utility crews, construction crews, etc.)
- Military personnel and trainees
- Athletes

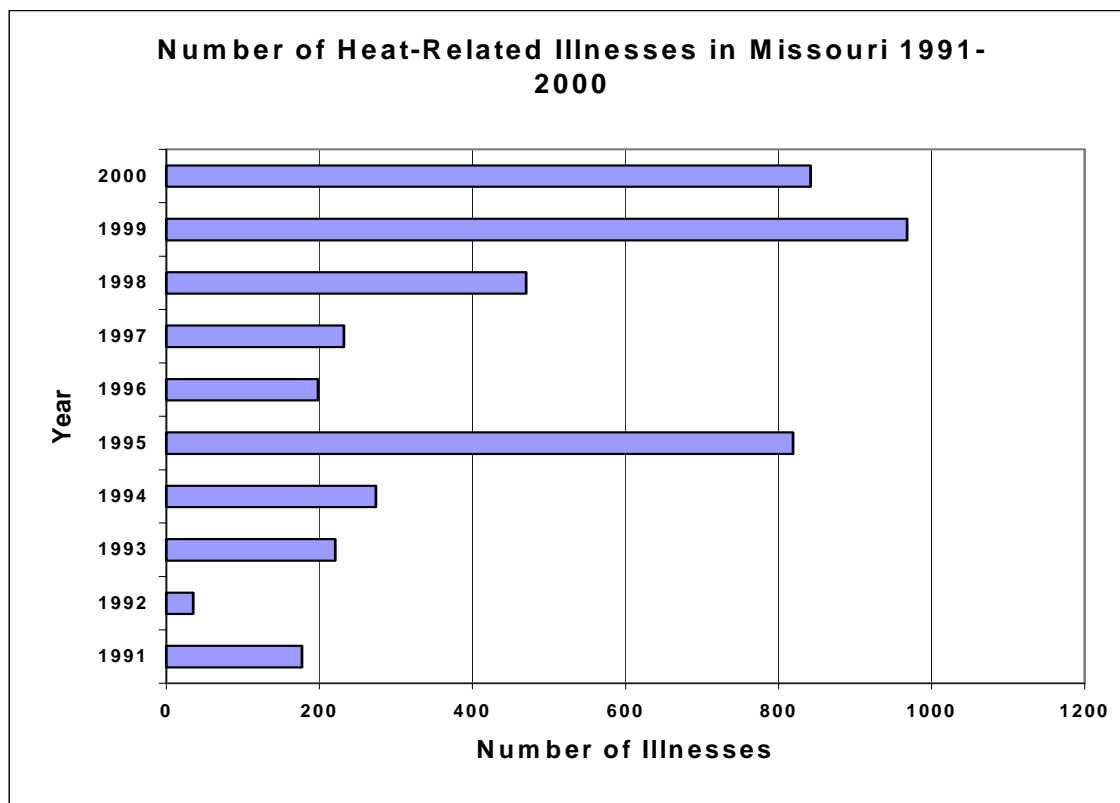
**Those More Difficult To Reach Through Normal Communications**

- People who live alone
- People who are homeless
- People who do not speak English
- People who cannot read
- People who are culturally, socially, or geographically isolated

Even when a heat injury is not fatal, it can be extremely serious and require lifelong monitoring of further exposure to heat. Besides mortality statistics due to heat, the Missouri Department of Health and Senior Services tracks heat-related injuries. **Figure 43** shows heat-related illnesses in Missouri from 1991 through 2000.

As previously mentioned, animals can be adversely affected by heat stress. This poses a risk to farmers, ranchers, and the entire State of Missouri, which relies on agricultural revenue to keep the economy strong. Livestock producers cannot afford to ignore the effects of high temperatures on their herds. The following symptoms are signs of heat stress on livestock:

**Figure 43. Heat Related Illnesses in Missouri (1991-2000)**



### **Synopsis**

Many people do not realize how deadly a heat wave can be. In contrast to the visible, destructive, and violent nature of floods, hurricanes, and tornadoes, a heat wave is a “silent killer.” Be aware of the warning signs of heat-related illness, such as light-headedness, mild nausea or confusion, sleepiness, or profuse sweating. To prevent heat-related illness, take the following precautions:

- Increase your fluid intake; drink more liquids than your thirst indicates.
- Drink nonalcoholic and caffeine-free liquids, such as water and juices.
- Wear lightweight, light colored, loose fitting clothing.
- When unaccustomed to working or exercising in a hot environment, start slowly and pick up the pace gradually; rest frequently in a shady area in the evening.
- Spend time in an air-conditioned place; if not at home, then spend time in such public places as libraries, supermarkets, shopping malls, and movie theatres.
- Do not rely on fans as your primary cooling devices during a heat wave.

- Schedule outdoor activities carefully, preferably before noon or in the evening.
- When working in the heat, monitor the condition of your co-workers and have someone do the same for you.
- Monitor those at high risk, such as the elderly, infants, and children up to 4 years of age, someone who is overweight, or someone on medication.
- Ask your physician whether you are at particular risk because of medication.
- Do not leave infants, children, or pets unattended in a parked car or other hot environments.

Although fans are less inexpensive to operate, they may not be effective, and may even be harmful when temperatures are very high. As the air temperature rises, airflow is increasingly ineffective in cooling the body until finally, at temperatures above 100 °F (the exact number varies with the humidity), increasing air movement actually increases heat stress. More specifically, when the temperature of the air rises to about 100 °F, the fan may be delivering overheated air to the skin at a rate that exceeds the capacity of the body to get rid of this heat, even with sweating, and the net effect is to add heat rather than to cool the body. An air conditioner, if one is available, is a much better alternative. More information on heat-related illness is available through the Department of Health's web page at [www.health.state.mo.us/ColdAndHeat/CandH.html](http://www.health.state.mo.us/ColdAndHeat/CandH.html).

### **3.2.9 Mass Transportation Accidents**

#### **Historical Statistics**

Commercial motor vehicles have been involved in a significant number of Missouri traffic accidents. In 2001, 10.4 percent of all traffic accidents involved a commercial motor vehicle. Of fatal traffic accidents, 14.4 percent involved a commercial motor vehicle. A total of 168 persons were killed and 6,003 were injured in commercial motor vehicle-related accidents in 2001. Commercial motor vehicles are defined as trucks having six or more tires on the power unit, buses or school buses having occupant capacities of 16 or more, and vehicles displaying hazardous materials placards. In 2001, accidents involving buses and school buses resulted in six fatalities.

In Light Rail Progress, June 2003, national statistics for transit passengers and motor vehicle occupants were reported; these are summarized in **Table 21**. National motor vehicle fatality and passenger-mile data are from the US Bureau of Transportation Statistics, May 2003. They are based on the average of 1990-2000 data (passenger-mile data for 2001 were not currently available).

Transit data are taken from the American Public Transportation Association (APTA) and the National Transit Database (NTDB) of the Federal Transit Administration (FTA), May 2003. Data for 1999-2001 were averaged (since all relevant data items were available for that period).



**Table 21. Fatality Rates Per 100 Million Passenger-Miles Highway Vehicle Occupants And Transit Passengers**

Highway Vehicles	0.89
Regional (“commuter”) rail	0.03
Rail rapid transit	0.47
Light rail transit	0.23
Bus	0.07

### **Measure Of Probability And Severity**

A major accident can occur at any time, even though all safety precautions are in place. Based on the latest available information, the probability and severity of a mass transportation accident are both rated as moderate.

### **Impact Of The Hazard**

A mass transportation accident, which could include those involving buses, could burden a local jurisdiction’s available medical services. To minimize this problem, mutual aid agreements with adjoining jurisdictions should be developed between ambulance services and the hospitals. This type of hazard could involve hazardous materials or a fire, which would compound the impacts of the incident. Severe weather could also hamper response efforts.

### **Synopsis**

The State of Missouri serves as a transportation crossroad for the United States. Branson, Missouri, which is located close to the state's southwestern border, has become a major tourist attraction. Because Branson is a small community, tourists represent a large portion of population. To meet the needs posed by the large number of tourists, the city has been expanding its services (number of hospital beds, fire equipment, ambulances, etc.) and is able to provide more assistance than other communities of its size. A mass transportation accident, which could include those involving buses, could burden a local jurisdiction’s available medical services. To minimize this problem, mutual aid agreements with should be developed between ambulance services and hospitals of adjoining jurisdictions. The risk of this type of incident is moderate. For additional information, see the 2001 Missouri Traffic Safety Compendium, available from the Statistical Analysis Center of the Missouri State Highway Patrol, a division of Public Safety.

## **3.2.10 Nuclear Power Plants**

### **Historical Statistics**

#### **Research Reactors**

Two research reactors are located in the State of Missouri: the University of Missouri-Rolla Reactor (UMRR) and the University of Missouri Research Reactor (MURR). The maximum hypothetical accident from either research reactor would place at risk only personnel working at the facilities or the public within the site boundary of the respective facilities. Both research reactors have emergency plans approved by the Nuclear Regulatory Commission (NRC) that conform with regulatory requirements in 10 CFR 50, Appendix E, and follow the guidance provided by Revision I to NRC Regulatory Guide 2.6, Emergency Planning for Research and

Test Reactors, March 1982, and ANSI/ANS-15.16, Emergency Planning for Research and Test Research Reactors, November 29, 1981.

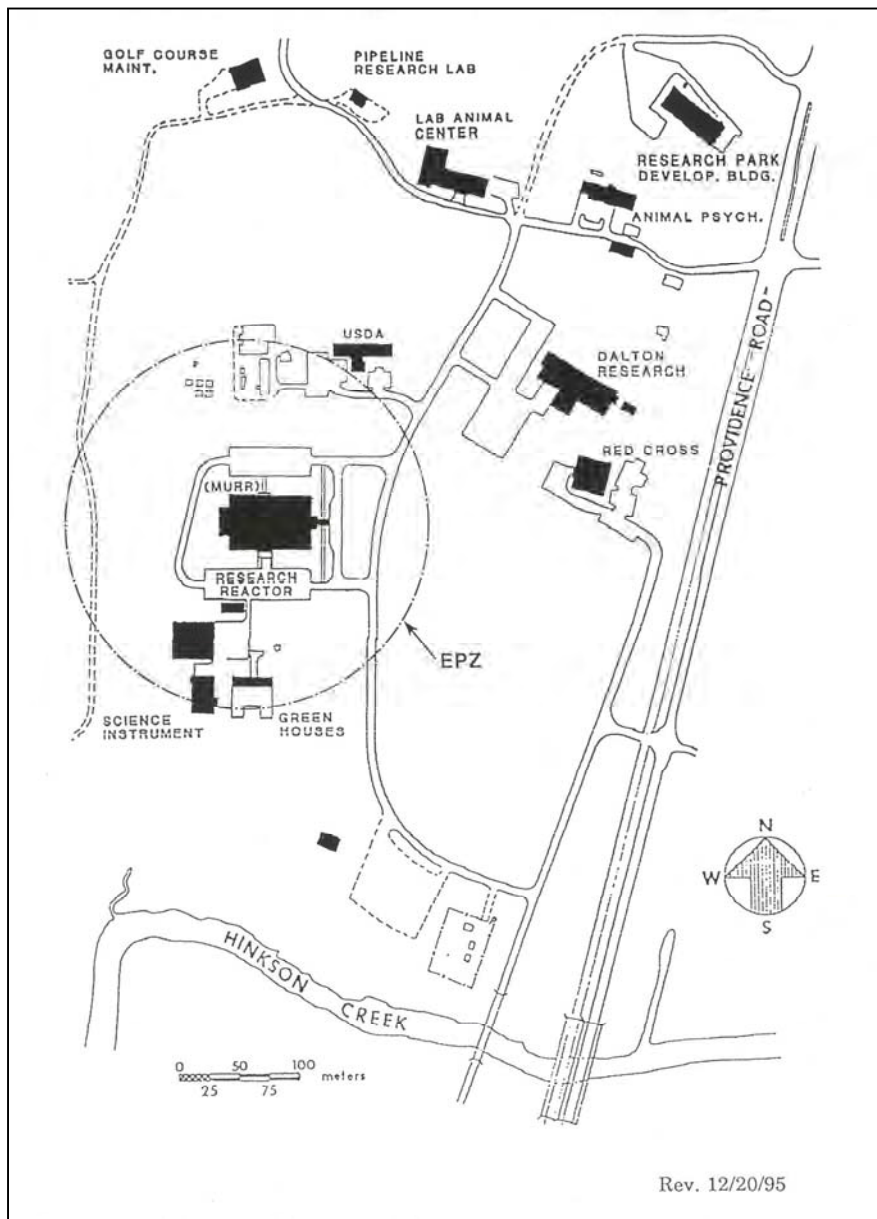
### **UMRR**

UMRR is a water-moderated pool-type reactor licensed to operate at 200 KW. The UMRR is used for training and research purposes. Because the reactor is mainly used for training, it is not operated for long periods of time. The reactor is located on the east side of the Rolla campus near 14th Street and Pine Street in Rolla, Missouri. Due to the low power of licensing (200 KW), prevailing standards and guidelines do not require the establishment of an emergency planning zone. Therefore, no classification higher than a Site Area Emergency has been included in the UMRR emergency plans. The UMRR has been in operation since December 1961 and has never had an incident that would be considered an emergency action level.

### **MURR**

MURR is a 10 MW pressurized water-moderated pool-type reactor with a containment building. The MURR is used to provide research, training, and services to the four campuses of the University of Missouri system, other universities, government agencies, and private industry as well. The reactor is located on a 550-acre tract of land south of the University of Missouri-Columbia campus on Providence Road. The MURR has an emergency planning zone (see **Figure 44**) encompassing the area within a 100-meter radius from the exhaust stack. No credible potential accidents have been identified for the MURR facility that would result in exceeding the classification of Notification of Unusual Events. As a result, no classification higher than a Site Area Emergency is included in the emergency plan for the MURR. The MURR has been in operation since October 1967. The reactor averages 8,060 hours of operation per year (155 hours per week) at peak flux due to the service work that it performs. During its history of operation, the MURR has never had an incident that would be considered an emergency action level.

**Figure 44. Emergency Planning Zone for MURR**



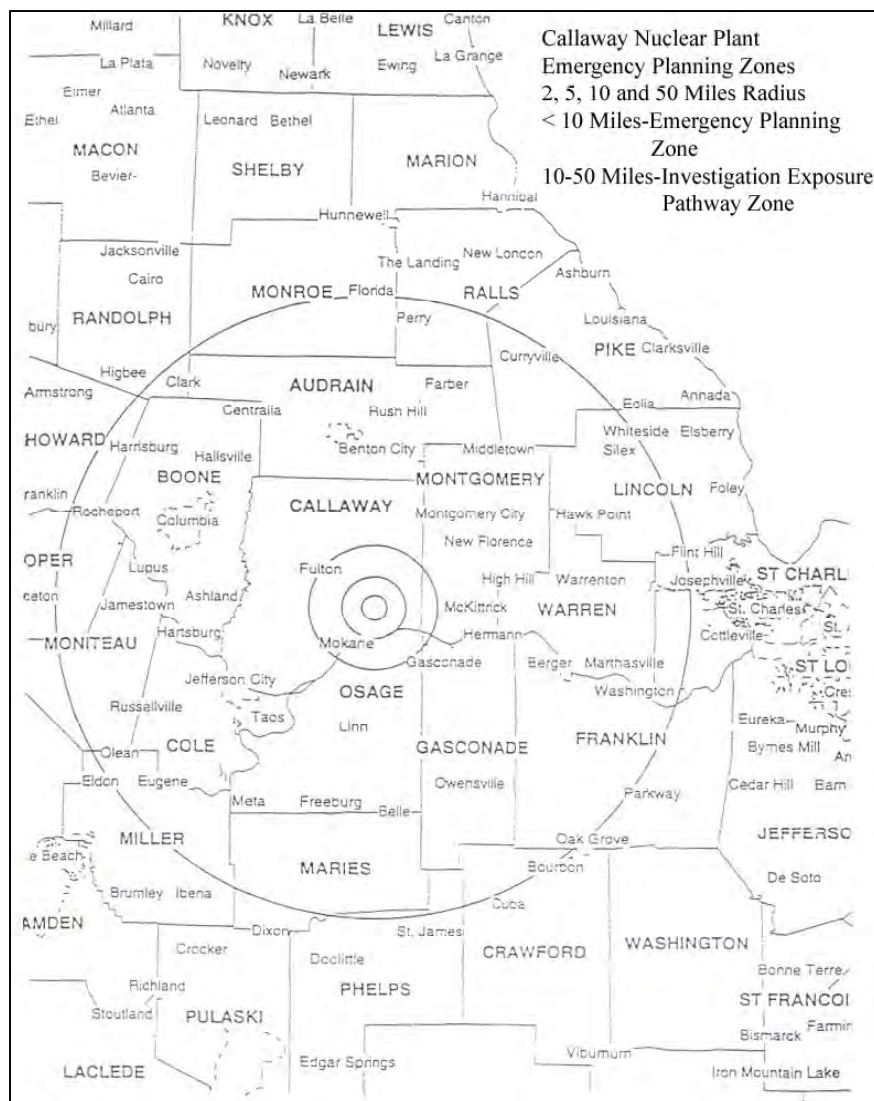
### **Commercial Nuclear Power Reactors**

Two commercial nuclear power reactors could have an impact on the health and safety of Missouri citizens. These reactors are the Callaway Nuclear Plant and the Cooper Nuclear Station, both of which are used for electrical power generation. Both utilities have emergency plans that conform to NUREG-0654, FEMA-REP-1 Rev.1, Criteria for Preparation and Evaluation of Radiological Emergency Response Plans and Preparedness in Support of Nuclear Power Plants. The utilities and the state are required to demonstrate annually various elements of preparedness through radiological emergency drills evaluated by inspectors representing FEMA and the NRC.

### Callaway Nuclear Plant

The Callaway Plant consists of one unit with a pressurized water reactor capable of providing 1150 megawatts of electricity. The plant is located in Callaway County, Missouri, and is owned and operated by Union Electric, St. Louis. It is located 10 miles southwest of Fulton, 25 miles northeast of Jefferson City, 5 miles north of the Missouri River, and 80 miles west of St. Louis. The population within the 2.5-mile radius of the plant is low (approximately 30 residents). Approximately 4,500 people reside within a 10-mile radius of the plant. The plume exposure pathway has been expanded beyond the 10-mile radius to include the City of Fulton (population 10,000). Thus, the population within the plume exposure pathway is approximately 16,000. The plant site consists of 7,200 acres of land at the site, 6,800 of which are administered by the Missouri Department of Conservation as the Reform Conservation Area. Under this program, part of the area continues to be farmed, with income from farming providing funds for wildlife management and public recreation activities. Land within a 5-mile radius of the plant site is rural, consisting of 60 percent forest, 20 percent farm/crop land, and 20 percent pasture.

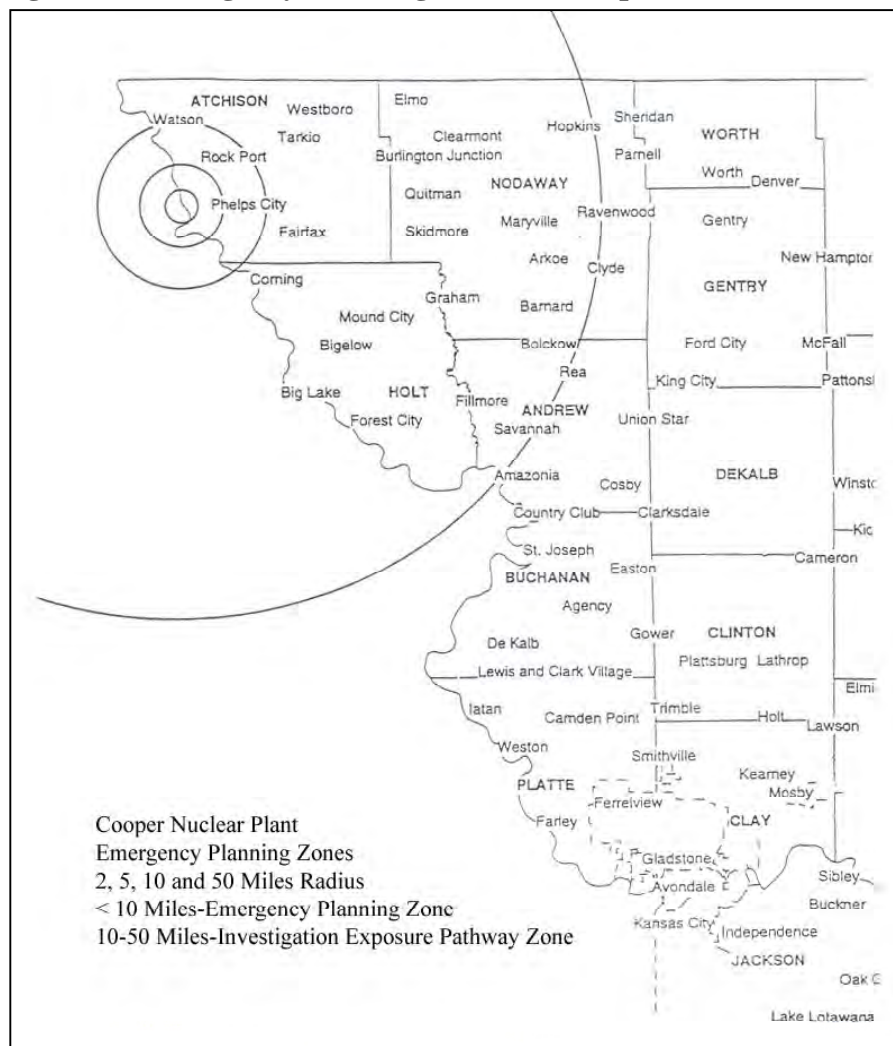
**Figure 45. Emergency Planning Zone for Callaway Nuclear Power Plant**



### Cooper Nuclear Station

The Cooper Nuclear Station is a direct-cycle boiling water-type reactor with a net electrical generating capacity of 800,000 kilowatts. The facility is owned and operated by the Nebraska Public Power District of Columbus, Nebraska. The plant is located on the Nebraska side of the Missouri River in Brownville, Nebraska, approximately 7 miles southwest of Rock Port, Missouri. The emergency planning zone (see **Figure 46**) within the Missouri side of the river is predominantly rural land, except for the towns of Rock Port, population 1,511; Phelps City, population 39; Langdon, population 32; and Watson, population 117. Atchison County is primarily affected by the emergency planning zone and is intersected by several major highways, including Interstate 29, U.S. Highway 136, U.S. Highway 275, and Missouri Highway 111. The total population at risk from a radiological incident in Atchison County is as follows: within 2 miles, approximately 15 people; within 5 miles, approximately 246 people; and within 10 miles, approximately 2,660 people.

**Figure 46. Emergency Planning Zone for Cooper Nuclear Station**



### **Measure Of Probability And Severity**

The consequences of a radiological incident originating from one of the commercial nuclear power plants affecting the state can range in severity from insignificant to a high degree of radioactive contamination within the a 2- to 10-mile radius surrounding the facility. The most crucial concerns during a severe incident are safe evacuation and controlled access to the areas affected by a release of radioactive materials. In the aftermath, the main concerns are the extent of property needing to be decontaminated, contaminated food sources, and the time required to reach acceptable exposure rates and to allow the safe reentry of the public. Historically, due to their safe operation records, fixed nuclear facilities have not represented a high risk to the state. The Reactor Safety Study conducted by the NRC rated the chances of a major nuclear disaster as very low (a probability of one in one million per plant operating year). The report concluded that the worst accident type that could affect a nuclear power plant would be one resulting in a meltdown, which could be expected to occur once in 20,000 years of reactor operation. The report also stated that a meltdown would likely cause less than one fatality or injury. This low hazard rating is due to all of the added safety engineered instrumentation used to monitor and shut down nuclear plant systems before any severe damage occurs.

### **Impact Of The Hazard**

An incident at a nuclear power plant resulting in a General Emergency and evacuation (one where a release from the site boundary would be expected) could have a dramatic psychological impact on the uninformed population within the evacuation zone. The utilities and the State of Missouri have an active Radiological Emergency Preparedness program to prepare local jurisdictions and the general population surrounding the plant for responding to such an incident. This program includes in-depth training of resources both from the state and local jurisdictions, and regularly scheduled drills and exercises evaluated by the Federal Emergency Management Agency. Extensive planning has focused on implementation of the emergency response plan for both the state and local jurisdictions. Emphasis is placed on prompt notification of emergency organizations and the public; evacuation routes; reception and care centers for evacuees; monitoring for radiological contamination; emergency worker preparedness; and public information in the form of brochures distributed to residents within the emergency preparedness zone. These programs are essential to the protection of the general public.

### **Synopsis**

Nuclear reactors have been designed to survive natural disasters such as tornadoes and earthquakes without damage to critical systems. Considerable emphasis is placed on multiple-level governmental reviews of the design, construction, and operation of each nuclear power plant. These safety reviews begin prior to construction and continue throughout the operating life of the plant. Radiological planning and preparedness programs monitored by state and federal agencies are in place to ensure that emphasis is placed on the safety of the general public within the emergency planning zone. In addition, the historical record for nuclear power plants gives no indication that a serious accident involving a nuclear power plant will occur.

### **3.2.11 Public Health Emergencies/Environmental Issues**

#### **Historical Statistics**

##### **Influenza Pandemics**

Epidemic influenza, an age-old infectious disease, kills several thousand men and women in the United States every year. Since the early 1900s, three lethal pandemics have swept the globe, although none have compared to the infamous Spanish Flu event of 1918-1919, which killed more than 20 million people. The 1957 Asian Flu and the 1968 Hong Kong Flu also were killers, although they weren't nearly as virulent as the 1918 strain. The 1957 epidemic killed about 70,000 people in the United States, mostly the elderly and chronically ill. Another 34,000 Americans died from the 1968 epidemic. While both of these latter epidemics cost many lives, neither was as severe as the Spanish Flu of 1918, which claimed more than 700,000 lives in the U.S. alone. Its primary victims were mostly young, healthy adults. In addition to those three pandemics, several "pandemic scares" have occurred.

##### **Spanish Flu of 1918-1919**

- In 1918, while World War I was in its fourth year, another threat began that would rival the war itself as the greatest killer in human history. The Spanish Flu swept the world in three waves during a 2-year period, beginning in March 1918 with a relatively mild assault. The first reported case occurred at Camp Funston (Fort Riley), Kansas, where 60,000 soldiers trained to be deployed overseas. Within 4 months, the virus traversed the globe, as American soldiers brought the virus to Europe. The first wave sickened thousands of people and caused many deaths (46 died at Camp Funston), but it was considered mild for what was to come. The second and deadliest wave struck in the autumn of 1918 and killed millions. At Camp Funston alone, there were 14,000 cases reported and 861 deaths during the first 3 weeks of October 1918. Outbreaks caused by a new variant exploded almost simultaneously in many locations, including France, Sierra Leone, Boston, and New York City, where more than 20,000 people died that fall. The flu gained its name from Spain, which was one of the hardest hit countries. From there, the flu went through the Middle East and around the world, eventually returning to the U.S. as the troops came home during its second wave. Of the 57,000 Americans who died in World War I, 43,000 died as a result of the Spanish influenza. At one point, more than 10 percent of the American workforce was bedridden. By a conservative estimate, a fifth of the human race suffered the fever and aches of influenza in 1918-1919, leaving 20 million people dead.
- In 1918, Missouri's influenza death rate was 293.83 per 100,000 people, for a total of 9,677 deaths statewide from that cause alone. That figure represents 18.6 percent of Missouri's total deaths that year. While the cause of the Spanish Flu remains somewhat a mystery, the epidemic was generally traced to pigs on Midwest farms, which then spread the deadly virus to farm families. As fall crops were ready for harvest in 1918, there were no field hands to get the crops in, thereby creating an agricultural disaster as well. A third wave of the Spanish Flu, much less devastating than its predecessors, made its way through the world in early 1919 and then finally died out.
- Missouri's flu death rate in 1919 dropped to less than half that of the previous year (107.21 per 100,000), and by 1921, it was reduced to 87.24 deaths per 100,000 people, state statistics show.

### **Asian Flu of 1957**

- In February 1957, this flu pandemic was first identified in the Far East. Unlike the Spanish Flu pandemic, the 1957 virus was quickly identified, and vaccine production began in May 1957. A number of small outbreaks occurred in the U.S. during the summer of 1957, with infection rates highest among school children, young adults, and pregnant women; however, the elderly had the highest rates of death. A second wave of infections occurred in early 1968, which is typical of many pandemics.

### **Hong Kong Flu of 1968**

- In early 1968, this influenza pandemic was first detected in Hong Kong. The first cases in the U.S. were detected in September 1968, although widespread illness did not occur until December. This became the mildest pandemic of the 20<sup>th</sup> century, with those over the age of 65 being the most likely to die. People with earlier infections by the Asian Flu virus may have developed some immunity against the Hong Kong Flu virus. Also, this pandemic peaked during school holidays in December, limiting student-related infections.

### **Flu Scares: Swine Flu of 1976, Russian Flu of 1977, and Avian Flu of 1997**

- Three notable flu scares have occurred in the 20<sup>th</sup> century. In 1976, a swine-type influenza virus appeared in a U.S. military barracks (Fort Dix, New Jersey). Scientists determined it was an antigenically drifted variant of the feared 1918 virus. Fortunately, a pandemic never materialized, although the news media made a significant argument about the need for a Swine Flu vaccine.
- In May 1977, influenza viruses in northern China spread rapidly and caused epidemic disease in children and young adults. By January 1978, the virus, subsequently known as the Russian Flu, had spread around the world, including the United States. A vaccine was developed for the virus for the 1978-1979 flu season. Because illness occurred primarily in children, this was not considered a true pandemic.
- In March 1997, scores of chickens in Hong Kong's rural New Territories began to die—6,800 on three farms alone. The Avian Flu virus was especially virulent, and made an unusual jump from chickens to humans. At least 18 people were infected, and six died in the outbreak. Chinese authorities acted quickly to exterminate over 1,000,000 chickens and successfully prevented further spread of the disease.

### **Other Diseases Of Public Health Concern**

- **Smallpox**

Smallpox is a contagious, sometimes fatal, infectious disease. There is no specific treatment for smallpox disease, and the only prevention is vaccination. Smallpox is caused by the variola virus, which emerged in human populations thousands of years ago. It is generally spread by face-to-face contact or by direct contact with infected bodily fluids or contaminated objects (such as bedding or clothing). A person with smallpox is sometimes contagious with onset of fever, but the person becomes most contagious with the onset of rash. The rash typically develops into sores that spread over all parts of the body. The infected person remains contagious until the last smallpox scab is gone.



Smallpox outbreaks have occurred periodically for thousands of years, but the disease is now largely eradicated after a worldwide vaccination program was implemented. After the disease was eliminated, routine vaccination among the general public was stopped. The last case of smallpox in the United States was in 1949.

It should be noted that after recent terrorist events in the U.S., there is heightened concern that the variola virus might be used as an agent of bioterrorism. For this reason, the U.S. government is taking precautions for dealing with a smallpox outbreak. For further information on this issue, see the Terrorism section of this report (Section N).

- **St. Louis Encephalitis**

In the United States, the leading type of epidemic flaviviral encephalitis is St. Louis encephalitis (SLE), which is transmitted by mosquitoes that become infected by feeding on birds infected with the virus. SLE is the most common mosquito-transmitted pathogen in the U.S. There is no evidence to suggest that the virus can be spread from person to person. Since 1964, there have been 4,437 confirmed cases of SLE, with an average of 193 cases per year. It should be noted, however, that less than 1 percent of SLE infections are clinically apparent, so the vast majority of infections remain undiagnosed. Illnesses range from mild headaches and fever to convulsions, coma, and paralysis. The last major outbreak of SLE occurred in the Midwest from 1974 to 1977, when over 2,500 cases were reported in 35 states. The disease is generally milder in children than in adults, with the elderly at highest risk for severe illness and death. Approximately 5 to 15 percent of cases are fatal; no vaccine against SLE exists.

- **Meningitis**

Meningitis is an infection of fluid that surrounds a person's spinal cord and brain. High fever, headache, and stiff neck are common symptoms of meningitis, which can develop between several hours to 1 to 2 days. Meningitis can be caused by either a viral or bacterial infection; however, a correct diagnosis is critically important, because treatments for the two varieties differ. Meningitis is transmitted through direct contact with respiratory secretions from an infected carrier. Primary risk groups include infants and young children, household contact with patients, and refugees. The disease is of most concern in Africa, where 213,658 cases were reported during 1996-1997, with 21,830 deaths. In the United States, periodic outbreaks continue to occur, particularly among adolescents and young adults. Generally, 10 to 15 percent of cases are fatal, and 10 to 15 percent of those who recover suffer from permanent hearing loss, mental retardation, loss of limbs, or other serious effects. Vaccines have been developed for some strains of meningitis, although some of those vaccines are not routinely used in the United States.

- **Lyme Disease**

Lyme disease was named after the town of Lyme, Connecticut, where an unusually large frequency of arthritis-like symptoms was observed in children in 1977. It was later found that the problem was caused by bacteria transmitted to humans by infected deer ticks, causing more than 16,000 reported infections in the United States each year (however, the disease is greatly under-reported). Lyme disease bacteria are not transmitted from

person to person. Following a tick bite, 80 percent of patients develop a red “bulls-eye” rash, accompanied by tiredness, fever, headache, stiff neck, muscle aches, and joint pain. If untreated, some patients may develop arthritis, neurological abnormalities, and cardiac problems, weeks to months later. Lyme disease is rarely fatal. During early stages of the disease, oral antibiotic treatment is generally effective, while intravenous treatment may be required in more severe cases. In the U.S., Lyme disease is mostly found in the northeastern, mid-Atlantic, and upper north-central regions, and in several counties in northwestern California. In 1999, 16,273 cases of Lyme disease were reported to the Centers for Disease Control and Prevention (CDC). There have been no reported cases of Lyme disease that originated in Missouri.

- **West Nile Virus**

West Nile virus is a flavivirus spread by infected mosquitoes and is commonly found in Africa, West Asia, and the Middle East. It was first documented in the United States in 1999. Although it is not known where the U.S. virus originated, it most closely resembles strains found in the Middle East. It is closely related to St. Louis encephalitis and can infect humans, birds, mosquitoes, horses, and other mammals. Most people who become infected with West Nile virus will have either no symptoms or only mild effects. However, on rare occasions, the infection can result in severe and sometimes fatal illness. There is no evidence to suggest that the virus can be spread from person to person. An abundance of dead birds in an area may indicate that West Nile virus is circulating between the birds and mosquitoes in that area. Although birds are particularly susceptible to the virus, most infected birds survive. The continued expansion of West Nile virus in the United States indicates that it is permanently established in the Western Hemisphere.

- **Severe Acute Respiratory Syndrome (SARS)**

Severe acute respiratory syndrome (SARS) is a respiratory illness that has recently been reported in Asia, North America, and Europe. Although the cause of SARS is currently unknown, scientists have detected in SARS patients a previously unrecognized coronavirus that appears to be a likely source of the illness. In general, humans infected with SARS exhibit fevers greater than 100.4°F, headaches, an overall feeling of discomfort, and body aches. Some people also experience mild respiratory symptoms. After two to seven days, SARS patients may develop a dry cough and have trouble breathing. The primary way that SARS appears to spread is by close person-to-person contact; particularly by an infected person coughing or sneezing contaminated droplets onto another person, with a transfer of those droplets to the victim’s eyes, nose, or mouth.

### **Environmental Incidents**

For information regarding historical incidents involving air and water pollution in Missouri, see Section 3.2.7.

### **Measure Of Probability And Severity**

Health officials agree there is a high probability we will see another dangerous new strain of the influenza virus sometime in the future. In fact, a worldwide influenza outbreak on the scale and severity of the Spanish Flu is not far-fetched, and is expected by many experts. Should such a

killer-virus strike today, the results in Missouri and elsewhere could be catastrophic. Today, a much larger percentage of the world's population is clustered in cities, making them ideal breeding grounds for epidemics. Additionally, the explosive growth in air travel means the virus literally could be spread around the globe within hours. Under such unique conditions, there may be very little warning time. Most experts believe we will have just one to six months between the time that a dangerous new influenza strain is identified and the time that outbreaks begin to occur in the U.S. Outbreaks are expected to occur simultaneously throughout much of the nation, preventing shifts in human and material resources that normally occur with other natural disasters. These and many other aspects make an influenza pandemic unlike any other public health emergency or community disaster.

Environmental concerns are also on the rise, with recent scientific data emphasizing the long-term impacts that air and water pollution can have on the ecology of the affected areas. With continued enforcement of regulatory standards for airborne releases and discharges to waterways, routine emissions by industrial facilities are relatively easy to monitor and control. However, the potential always remains for unauthorized dumping and releases, and for failure of systems to control industrial discharges, resulting in potential environmental emergencies.

### **Impact Of The Hazard**

For planning purposes, it is reasonable to assume a rapid movement of a pandemic flu virus from major metropolitan areas to rural areas of the state. The effect of a pandemic on individual communities would likely be relatively prolonged—weeks to months. The impact of the next pandemic could have a devastating effect on the health and well being of Missouri citizens and the American public. For such an outbreak in the future, CDC estimates that in the U.S. alone:

- Up to 200 million persons will be infected.
- Between 40 and 100 million persons will become clinically ill.
- Between 18 and 45 million persons will require outpatient care.
- Between 300,000 and 800,000 persons will be hospitalized.
- Between 88,000 and 300,000 people will die nationwide.

Effective preventive and therapeutic measures, including vaccines and antiviral agents, likely will be in short supply, as well as some antibiotics to treat secondary infections.

Based on the CDC's preliminary estimates, economic losses from the next pandemic may range from \$71 to \$166 billion, depending on the attack rate.

Compared to public health emergencies, as previously described, environmental incidents involving air and water pollution would likely impact a more localized area; however, long-term affects on the environment in the impacted area could linger for many years.

### **Synopsis**

#### **Public Health Emergencies**

The Missouri Department of Health and Senior Services (MDHSS) and the State Emergency Management Agency (SEMA) were selected by the CDC and the Council of State and Territorial Epidemiologists (CSTE) to test a national plan for dealing with a catastrophic flu outbreak.

MDHSS and SEMA designed an interactive exercise, “FLUEX ’98,” to test two draft national response documents: (1) Influenza Pandemic Preparedness Action Plan for the United States, and (2) Pandemic Influenza: A Planning Guide for State and Local Officials. These documents were used for the design of FLUEX, and during the exercise itself. FLUEX was held February 4-5, 1998, in the State Emergency Operations Center at SEMA headquarters in Jefferson City, Missouri, and included more than 100 participants. Missouri was the only state in the nation to hold such an exercise, and one of only six states to help test the proposed national plan. Major topics explored during FLUEX included the following:

- Identifying quickly circulating viruses;
- Allocating potentially scarce vaccine supplies;
- Communicating emergency health information to the public; and
- Keeping essential public safety services operating during a time of widespread illness among employees.

As a follow-up to that planning event, FEMA conducted a satellite videoconference on planning for an influenza pandemic, which was broadcast nationally on February 25, 1999. SEMA, MDHSS, and local health departments hosted sites for the telecast across the state. The videoconference highlighted Missouri’s planning efforts to date and featured health officials from Connecticut and Maine. They joined with a special panel at CDC headquarters in Atlanta, including SEMA’s exercise officer, to answer a wide range of call-in questions on crisis management for a pandemic.

The sudden and unpredictable emergence of pandemic influenza and its potential for causing severe health, social, and economic consequences strongly requires the need for a comprehensive, action-oriented strategy. Principal goals of the national plan are two-fold: to improve prevention and control of influenza in the U.S. during the present (interpandemic) period, and to identify and implement specific ways and procedures to improve readiness for a future pandemic. As the CDC revises the draft national plan, Missouri will prepare an emergency response plan to deal with an influenza pandemic on the state level. MDHSS emphasizes that Missouri needs to prepare now to deal with challenges that could arise, such as vaccine shortages, widespread illness, and disruption in essential services.

### **Environmental Issues**

Although Missouri has never had an environmental disaster of large proportions, there are many instances where hazardous substances can impact the environment with considerable consequences to either air or water. Floods often temporarily interrupt community water supplies, creating the need for emergency potable water for thousands of people. In July 1993, for example, St. Joseph’s municipal water plant was forced to shut down for an extended period when contaminated floodwater threatened to enter the system. Floodwaters also disrupt wastewater treatment facilities, resulting in the discharge of raw or improperly treated sewage. Periodically, water pollutants cause fish kills in Missouri streams, and excessive air pollutants associated with smog in large metropolitan areas create public health problems.

## Air Pollution

Air quality in Missouri is monitored at 72 stations throughout the state. These stations are maintained by the U.S. Environmental Protection Agency (EPA), as well as by state and local authorities. These stations can be divided into three separate groups: National Air Monitoring Stations (NAMS), State and Local Air Monitoring Stations (SLAMS), and Special Purpose Monitors (SPM). These monitors measure suspended particulate, ozone, carbon monoxide, sulfur dioxide, nitrogen dioxide, and lead. Lead is of particular interest because Missouri's lead industry produces about 90 percent of the new lead in the nation. The three large lead smelters in Missouri (near Herculaneum) have their own monitoring network operated by the company that runs the smelters. The state monitors the network to ensure proper function, and all data are forwarded to EPA. The EPA maintains a list of facilities that release the most toxic chemicals each year. Missouri's five top facilities for 2000 are shown in **Table 22**. The top 10 chemicals released in the state are shown in **Table 23**.

**Table 22. Top Ten Facilities In Missouri Showing Greatest Releases (2001)**  
(All Figures Are In Pounds)

Facility	County	Air	Water	Land	Total*
Doe Run Co. Herculaneum Smelter	Jefferson	261,169	442	15,182,450	15,444,061
Buick Mine/Mill	Iron	55,729	5,495	13,518,560	13,579,784
Brushy Creek Mine/Mill	Reynolds	34,192	2,175	12,762,208	12,798,575
Fletcher Mine/Mill	Reynolds	37,408	1,770	11,661,687	11,700,865
Doe Run Co. Glover Smelter	Iron	40,114	107	9,396,570	9,436,791
Ameren Sioux Power Plant	St. Charles	2,376,500	9,470	1,557,061	3,943,031
Sweetwater Mine/Mill	Reynolds	12,138	520	3,845,748	3,858,406
Meramec Power Plant	St. Louis	2,110,525	12,186	1,580,080	3,702,791
Royal Oak Ent., Inc, Ellsinore, MO	Carter	2,714,500	0	0	2,714,500
Ford Motor Company – Kansas City	Clay	2,635,667	0	0	2,635,667

\* Total amounts do not include off-site releases (i.e., metals at wastewater treatment plants, disposal-related incidents); Missouri had no releases in 2001 through underground injection.

**Table 23. Top Ten Chemicals Reported In Missouri (2001)**  
(All Figures Are In Pounds)

Chemical	Air	Water	Land	Total*
Zinc Compounds	469,929	15,910	31,123,423	31,609,262
Lead Compounds	415,337	3,448	27,854,543	28,273,328
Barium Compounds	160,735	104,257	6,791,576	7,056,568
Hydrochloric Acid ("acid aerosols" only)	5,874,476	0	168,005	6,042,481
Methanol	5,868,430	12,713	5	5,881,148
Copper Compounds	20,270	2,900	4,658,137	4,681,307
Aluminum (fume or dust)	15,413	255	3,280,796	3,296,464
Xylene (mixed isomers)	2,990,415	0	0	2,990,415
Hydrogen Fluoride	2,464,416	0	158,300	2,622,716
Sulfuric Acid ("acid aerosols" only)	1,748,549	5	480,255	2,228,809

\* Total amounts do not include off-site releases (i.e., metals at waste water treatment plants, disposal-related incidents).

Because of high amounts of ozone, carbon dioxide, nitrogen compounds, and other vehicular pollutants in the St. Louis metropolitan area, vehicles registered in the counties of St. Louis, St. Charles, and Jefferson, as well as St. Louis City, are required to have their exhaust systems routinely checked to determine whether emissions standards are being achieved. In addition, all service stations around St. Louis are now required to have new gas nozzles that recapture gasoline vapors, thus preventing them from being released to the atmosphere. These vapors (unburned hydrocarbons) chemically react with nitrogen oxides when exposed to the sunlight and form ozone, which is the basis for smog. For more information on Missouri's Air Pollution Control Program, contact the Missouri Department of Natural Resources.

### **Water Pollution**

The Missouri Department of Natural Resources also maintains the state's water quality management plan, and has developed individual plans for each drainage basin in Missouri. Those drainage basins may be divided into the following geographic categories: Upper Mississippi River tributaries, Lower Mississippi River tributaries, Missouri River tributaries north of the Missouri River, Missouri River tributaries south of the Missouri River, White River tributaries, and Arkansas River tributaries.

There are 22,194.2 miles of classified Missouri streams (i.e., permanently flowing streams or streams that maintain permanent pools during dry weather). Of these waters, 48 percent (10,707.3 miles) meet clean water goals for all recognized uses. There are 203.2 miles that cannot be assessed. The remaining 11,283.7 miles of water do not meet clean water goals for all recognized uses, but only 626.4 miles are considered to have serious water quality problems (i.e., to the point where at least one recognized use of the water body has been lost).

There are 293,319 acres of classified lakes in Missouri. Of that area, 69 percent (202,668 acres) meet clean water goals for all recognized uses. There are 70 acres that cannot be assessed. The remaining 90,581 acres do not meet clean water goals for all recognized uses, with 46,810 acres considered to have serious water quality problems (i.e., to the point where at least one recognized use of the water body has been lost).

The most recent available water quality report indicates that the most important pollutant-related issues in Missouri are as follows:

- Mercury levels in fish appear to be increasing over time.
- Twenty Class I and 380 Class II confined animal feeding operations in Missouri generate large amounts of manure, creating the potential for serious water problems.
- Eutrophication of large, recreationally important reservoirs appears to be increasing, possibly due to increased confined animal production in the watersheds of these lakes.
- Tailings from abandoned lead-zinc mines continue to impact waters long after mining operations have ceased.

The water quality report also identifies several other water quality concerns as follows:

- Channelization has caused aquatic habitat degradation in 17 percent of Missouri's streams, as well as promoted increased water velocities, streambank erosion, and severity of flooding.

- Additional groundwater protection measures are needed, including a complete groundwater monitoring network and educational programs for those involved in the application of farm chemicals, transporters of hazardous materials, and the general public.
- Continued suburban development impacts streams by loss of stream channels, removal of riparian areas, and activities that result in increased storm water flows.
- Evidence indicates that fish and invertebrate communities in many Missouri streams are suffering from the degraded quality of the aquatic habitat.

For more information on Missouri's Water Pollution Control Program, contact the Missouri Department of Natural Resources at (573) 751-1300.

### **Identifying Pollution Hazard Areas**

Local emergency management officials should identify pollution hazard areas so that in case of a natural disaster, recovery steps will not be delayed. Pollution of public drinking water, for example, can cause severe problems with re-entry and recovery. If alternate sources of safe drinking water can be identified, or relocation of water intakes can eliminate polluted drinking water, then recovery can be quicker, and local resources can be used to address other problems.

With the increases in motor vehicle registrations throughout the state, the levels of nitrocarbon emissions will naturally rise. Combinations of smog and carbon monoxide levels will also increase. These pollutants in sufficient quantities can have deleterious effects on the health of thousands of Missourians.

## **3.2.12 Riverine Flooding (Major and Flash)**

### **Historical Statistics**

Missouri has a long and active history of extensive flooding over the past century. Scores of river communities, such as those along the Mississippi and Missouri Rivers, have become quite skilled and experienced in flood-fighting efforts due to frequent instances of severe flooding in recent years. Flooding along Missouri's major rivers generally results in slow moving disasters. River crest levels are forecast several days in advance, allowing communities downstream sufficient time to take protective measures, such as sandbagging and evacuations. Nevertheless, these flood disasters extract a heavy toll in terms of human suffering and extensive losses to public and private property. By contrast, flash flood events in recent years have caused a higher number of deaths and major property damage in many areas of Missouri.

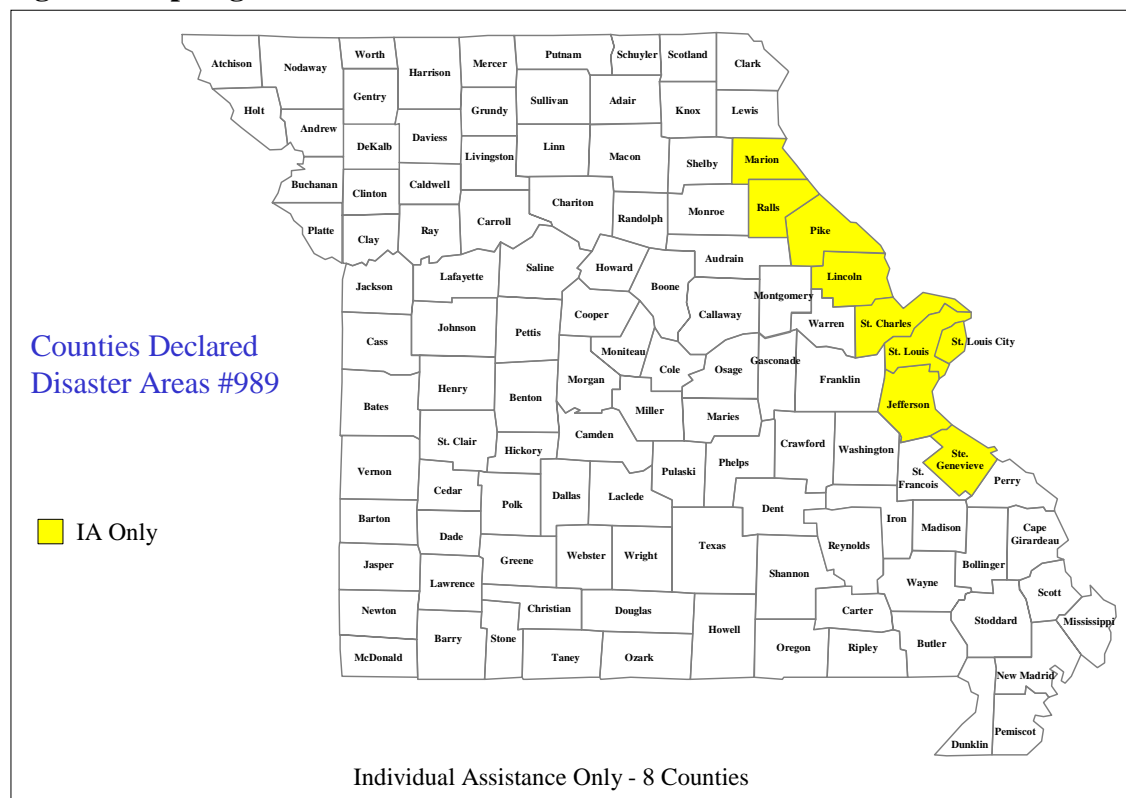
Ranking among the state's most notable flood disasters are the Missouri River flood of 1927, which spread destruction across 17 million acres, and the flood of 1951, which caused an estimated \$400 million in damage. Record flooding also occurred in 1973 along the Mississippi River, where backwater inundated 474,000 acres at a loss of \$40 million. The unseasonably heavy rainfall produced severe headwater flooding along many of the area's tributary streams, particularly in the St. John's Basin in Missouri and along the St. Francis and White Rivers in Arkansas. Of special historic interest is the December 1982 flood that spread dioxin-contaminated soil in the Times Beach area near St. Louis and led to a federal buyout of the entire town. In the fall of 1986, record flooding returned in Missouri, as well as in Michigan, Illinois,

Kansas, and Oklahoma, with all these states declared federal disaster areas. Significant flooding next occurred in the state in the spring of 1990, particularly along the Missouri River in western, central, and portions of eastern Missouri. Record-level, repetitive flooding occurred from 1993 through 1995, and flash flooding ravaged several areas of the state in July and October 1998. In the springs of 1999 and 2000, flash flooding and severe storms again battered portions of the state.

### Floods of 1993-1995

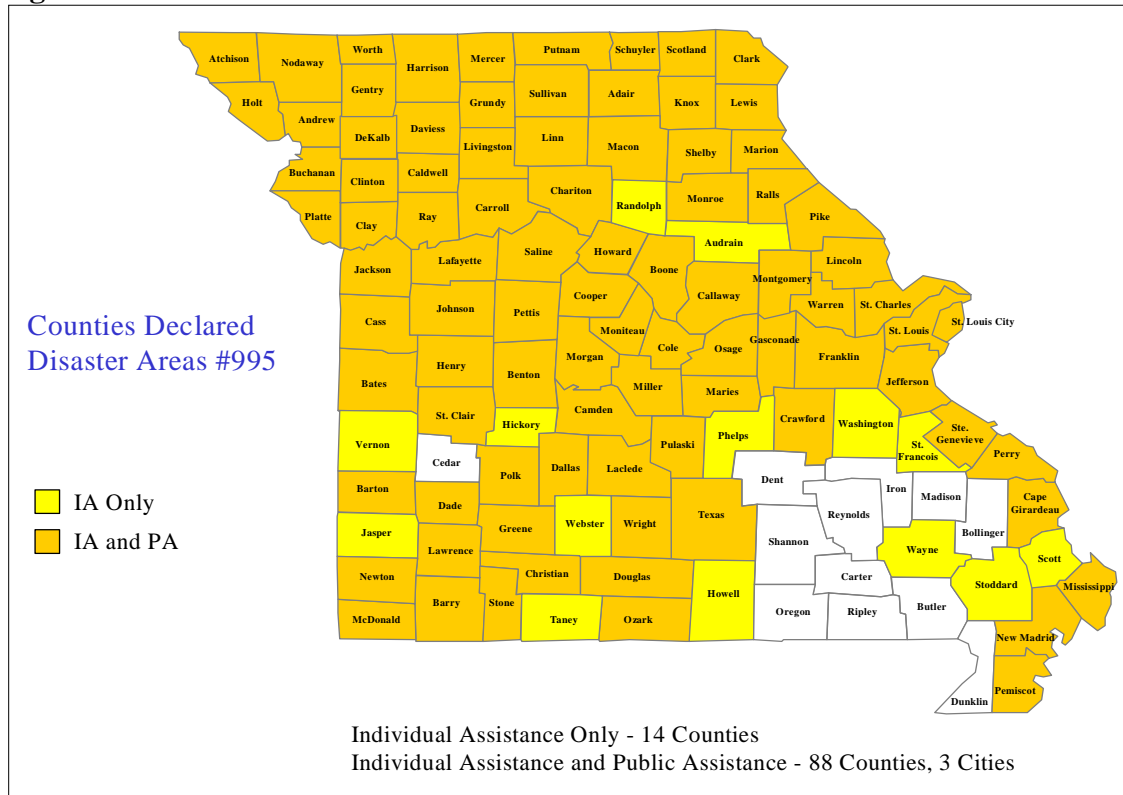
The floods of 1993 through 1995 represent Missouri's worst repetitive flood events. Within this time frame were five presidential disaster declarations, including four in just one 12-month period (see **Figures 47 – 51**). This period extended from May 6, 1993, when the first declaration was issued by then-President Clinton, to April 17, 1994, when the fourth declaration was approved. Flooding in the spring of 1995 resulted in a fifth disaster declaration, issued on June 2, 1995. The ravages of these floods left a legacy of destruction, human suffering, and property damage of unprecedented terms in Missouri history. The fact that Missouri would need several years to recover from these repetitive flood disasters was undisputed. In 1993 alone, a total of 112 of Missouri's 114 counties were included in at least one or more of the declarations. Only Cedar County in southwest Missouri and Dunklin County in the southeast portion of the state were not included in any of the 1993 declarations. See **Table 24** for record high-water stages (in feet) and **Table 25** for the distribution of levee failures resulting from the 1993 Summer Floods.

**Figure 47. Spring 1993 Flood**





**Figure 48. Summer 1993 Flood**



**Table 24. Record High-Water Stages in Missouri During The Summer 1993 Flood (In Feet)**

River	1993 Level	Previous Record	Flood Stage
<b>Mississippi River</b>			
Hannibal	31.8	28.6	16
St. Louis	49.4	43.3	30
Cape Girardeau	48.0	45.6	32
<b>Missouri River</b>			
St. Joseph	32.7	26.8	
Kansas City	48.9	46.2	17
Jefferson City	38.6	34.2	32
Hermann	36.3	35.8	23
St. Charles	39.5	37.5	21

Source: U.S. Army Corps of Engineers (1993)

**Table 25. Distribution Of Levee Failures By Corps Of Engineers District  
Number Of Failed Or Overtopped Levees, Summer 1993 Flood**

Corps of Engineers District	Federal Levees	Non-Federal Levees
St. Louis*	12 of 42	39 of 47
Kansas City**	6 of 48	810 of 810

Source: *Natural Disaster Survey Report, "The Great Flood of '93."*

\*Includes eastern Missouri and portions of Illinois.

\*\*Includes northwestern, west-central, and portions of southwest Missouri, and areas in Kansas and Nebraska.

Notes: The difference in the failure rates above is because most federal levees are designed to withstand a 100- to 500-year flood, while non-federal levees, predominantly protecting agricultural lands, are frequently designed for a flood with a return period of 50 years or less.

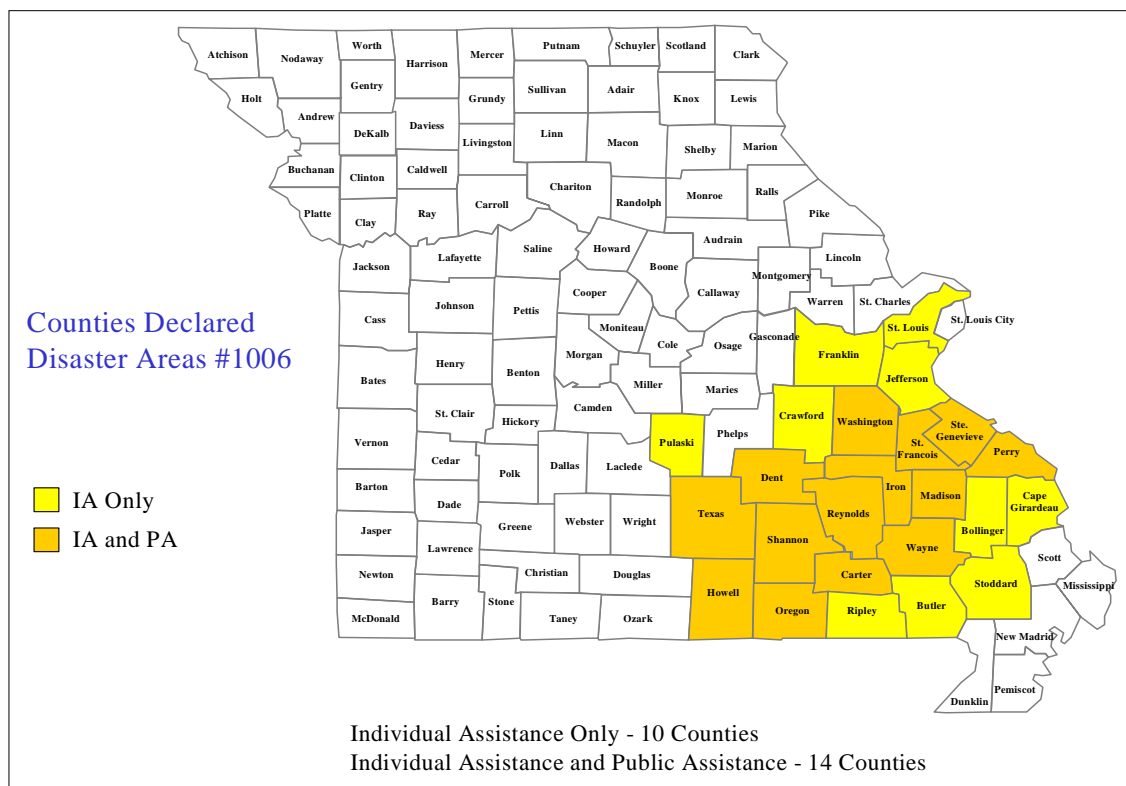
For information on specific river and stream gauge levels go to:

Kansas City/Pleasant Hill: [www.crh.noaa.gov/cgi-bin/ahps.cgi?eax](http://www.crh.noaa.gov/cgi-bin/ahps.cgi?eax).

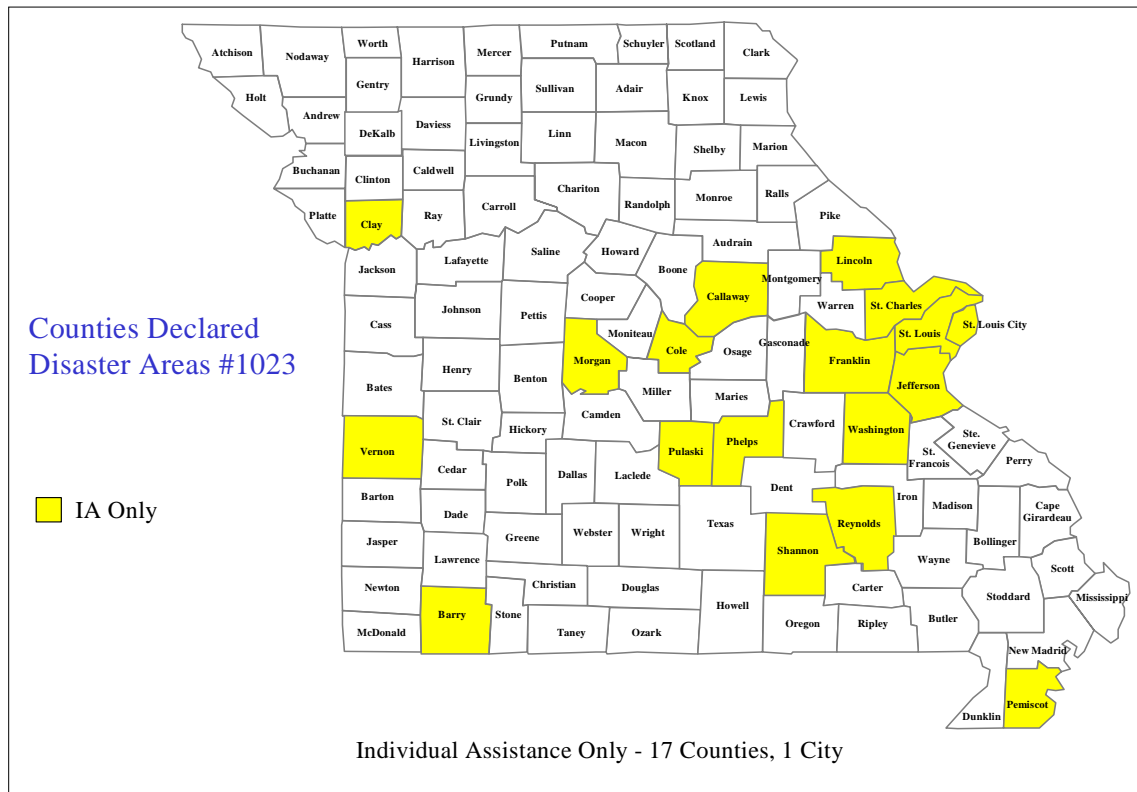
Springfield: [www.crh.noaa.gov/cgi-bin/ahps.cgi?sgf](http://www.crh.noaa.gov/cgi-bin/ahps.cgi?sgf)

St. Louis: [www.crh.noaa.gov/cgi-bin/ahps.gfi?lsx](http://www.crh.noaa.gov/cgi-bin/ahps.gfi?lsx).

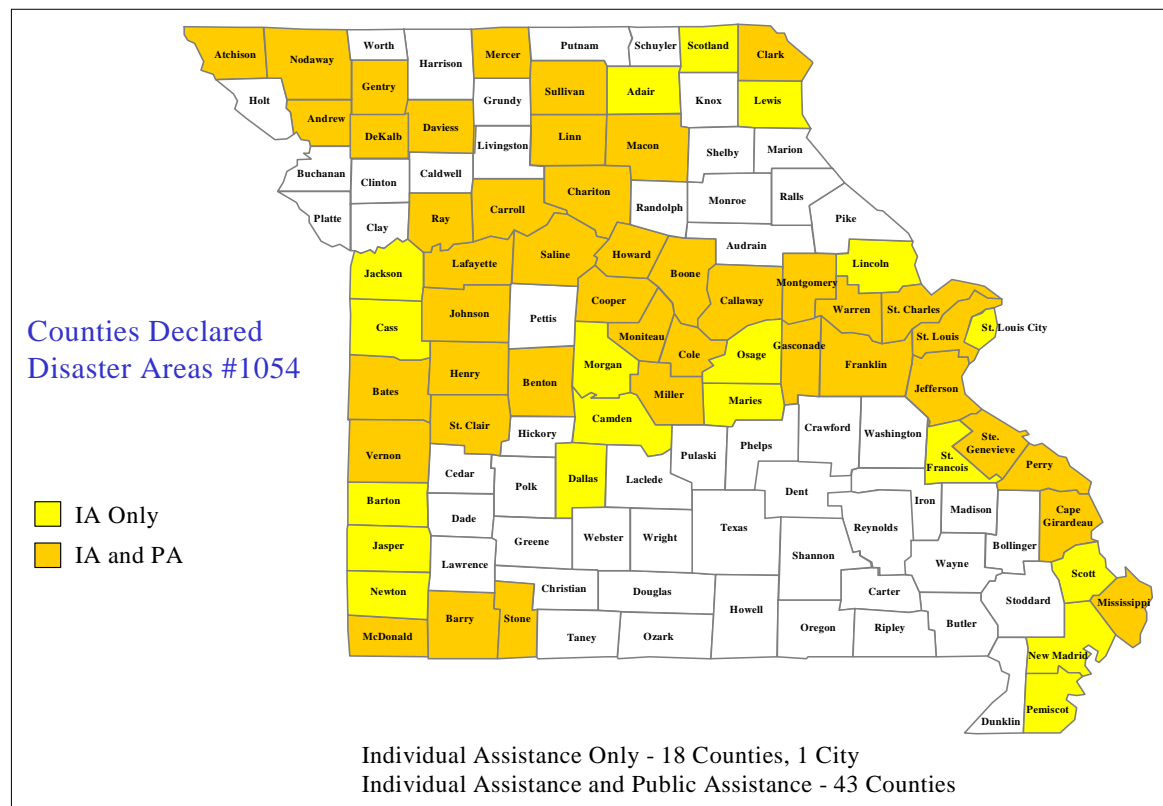
**Figure 49. Fall 1993 Flood**



**Figure 50. Spring 1994 Flood**



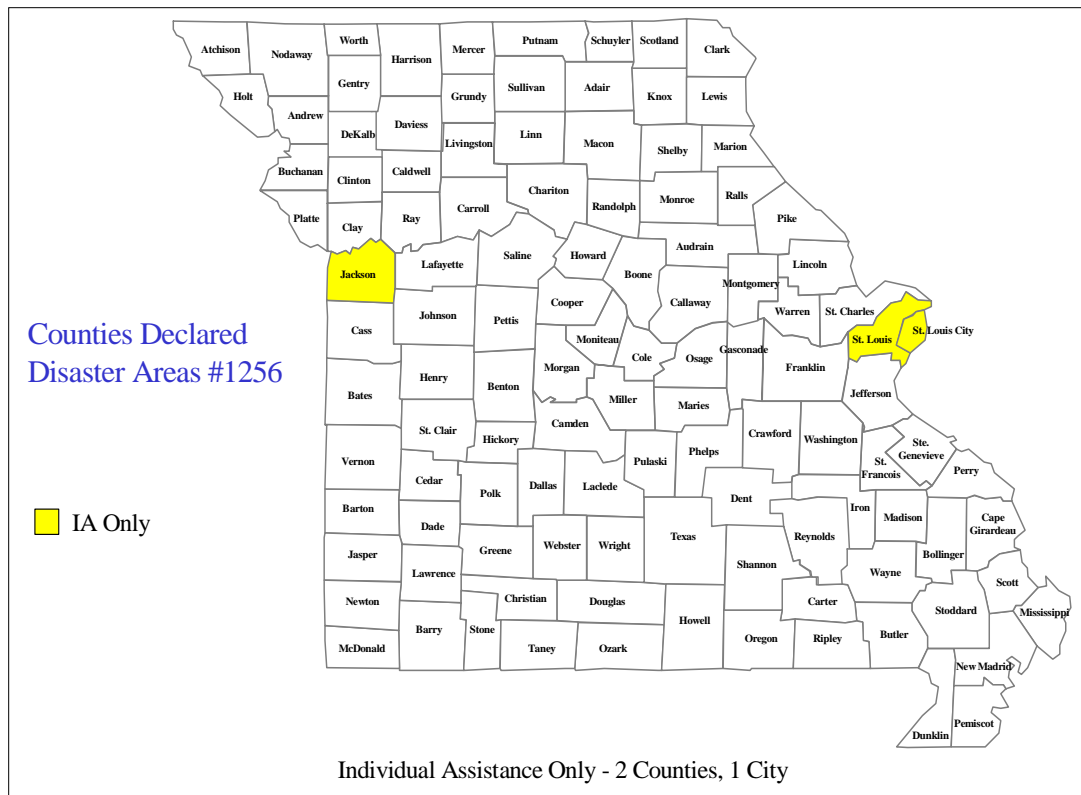
**Figure 51. Spring 1995 Flood**



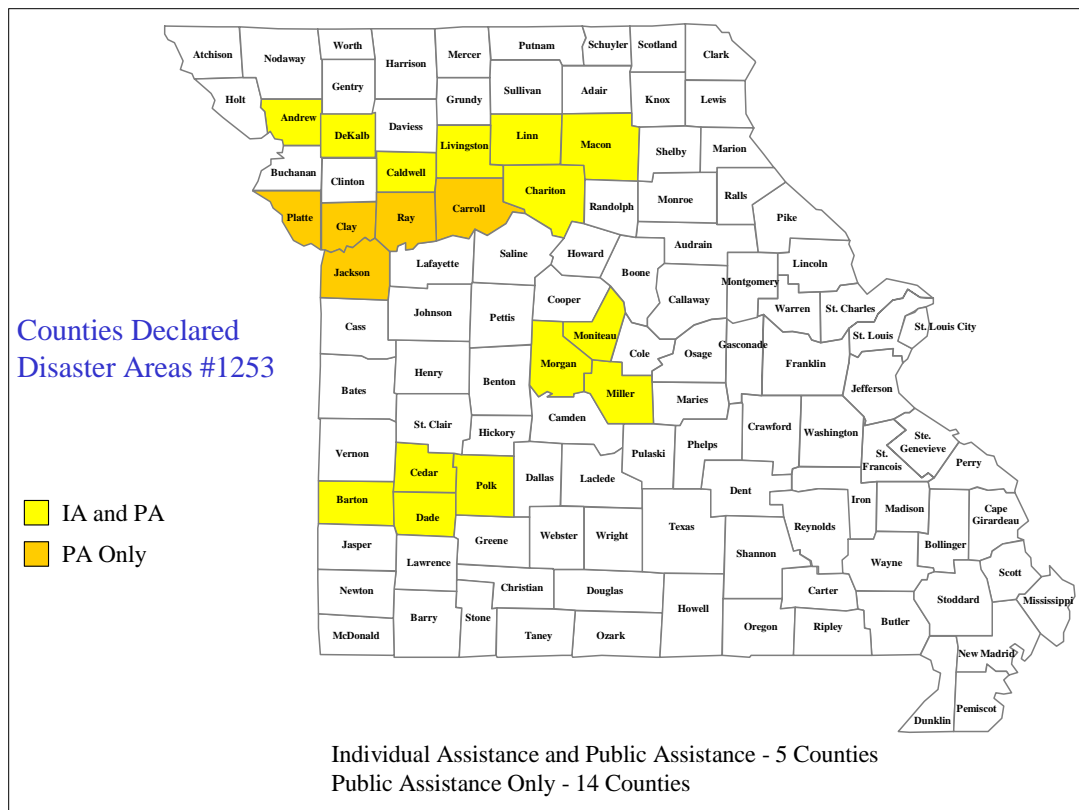
## Floods of 1998

Severe flash flooding in the summer and fall of 1998 took a heavy toll in terms of lives lost and extensive property damage in several areas of the state. In all, at least 17 people died as a result of the two flood events. Almost all of the casualties occurred when people attempted to drive their vehicles through rushing water, overturned their vehicle into floodwaters, or were trapped and swept off a flooded bridge. Both flood incidents ultimately resulted in presidential disaster declarations to provide state and federal assistance in the declared counties (see **Figures 52 – 53**).

**Figure 52. Summer 1998 Flood**



**Figure 53. Fall 1998 Flood**



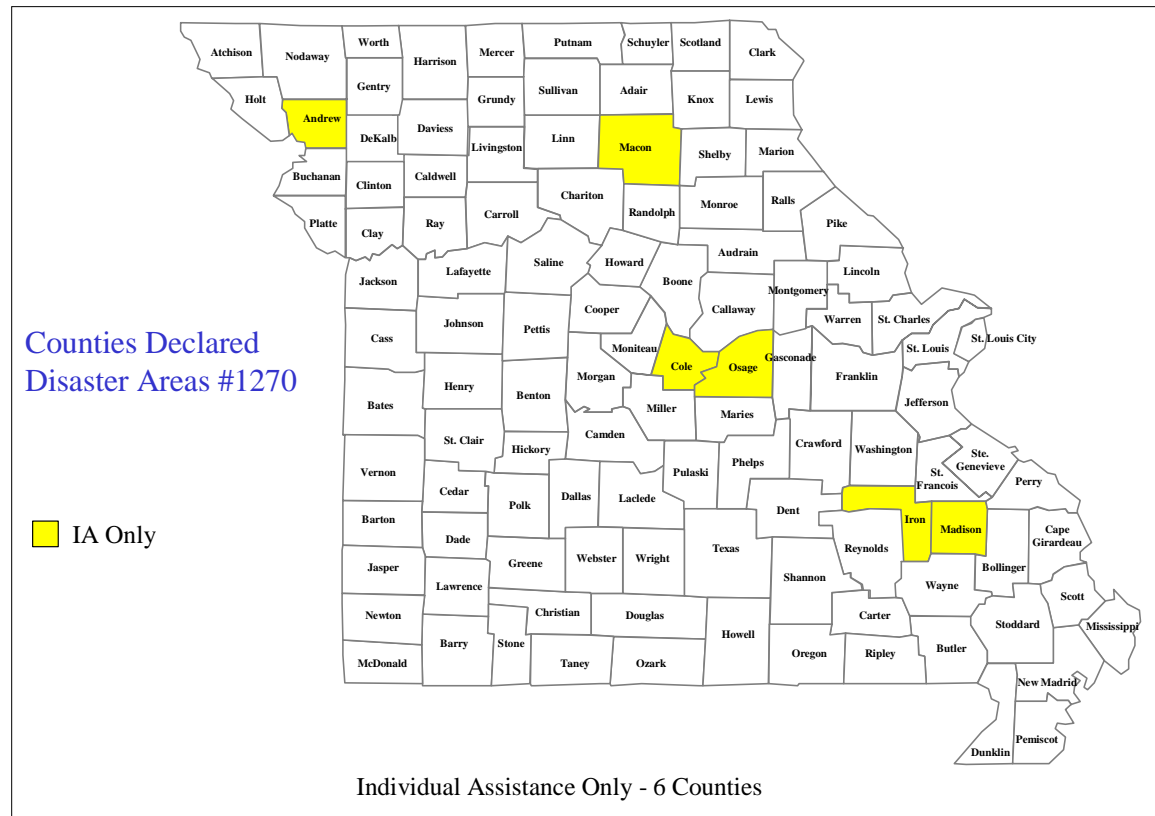
### Spring 1999 and 2000 Floods

On April 3, 1999, a heavy rainstorm in southeast Missouri caused severe flash flooding in Madison County, including the communities of Fredericktown and Marquand. One death (due to electrocution) was attributed to that flood event when 7 to 10 inches of rain fell over a two-hour period, causing the St. Francois River to crest at twice the height of flood stage. More than 400 homes were adversely affected, with nearly half receiving significant water damage within the living spaces. Seven businesses were damaged, and five were determined to be destroyed. On April 20, 1999, a presidential disaster declaration for individual assistance (MO-DR 1270) was approved for Madison County and five additional counties (Andrew, Cole, Osage, Iron, and Macon) were later approved by FEMA as add-ons to that declaration as a result of subsequent tornadoes and storms (see **Figure 54**). More than 30 Missouri counties were also designated as eligible for disaster relief for agricultural losses suffered from the April storms.

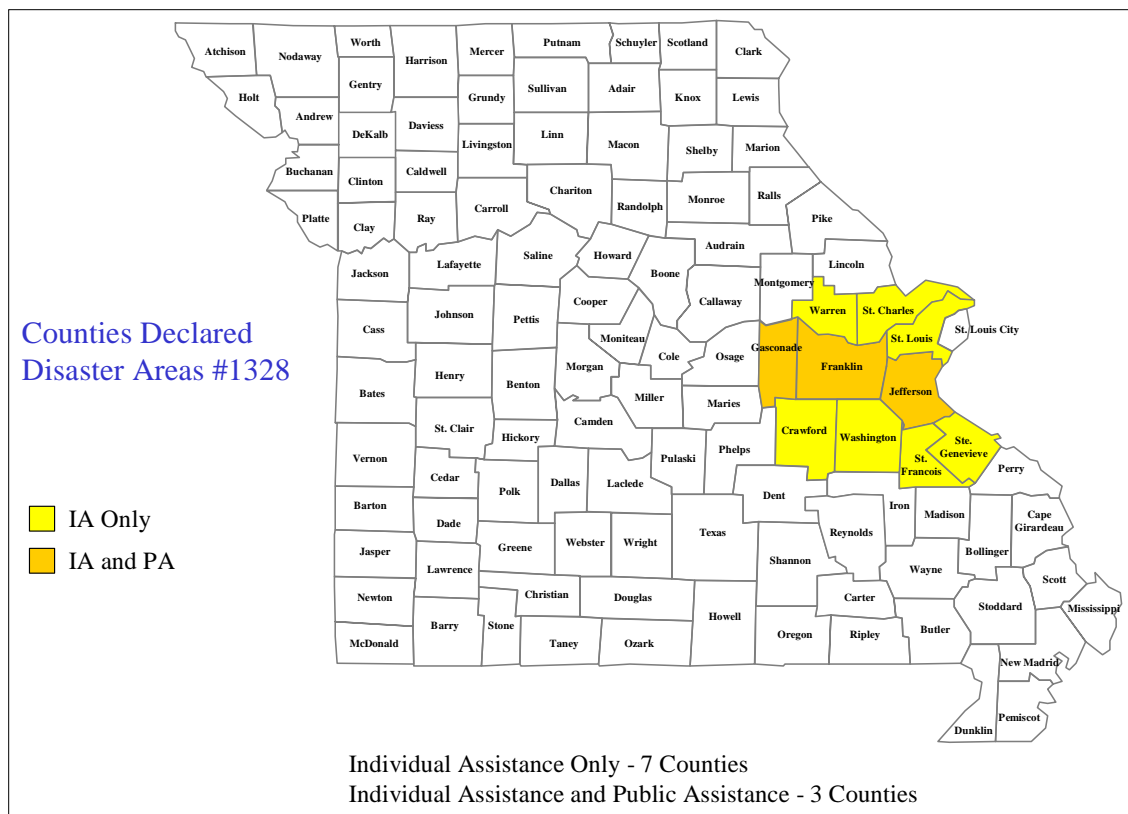
For two consecutive spring seasons, Missouri experienced devastating flash flooding that forced hundreds of people from their homes and caused millions of dollars in property damage to both homes and businesses. Although the flash flooding in both events was confined to few areas, the type of devastation was equal or greater than some of Missouri's worst river flooding events. On May 6 and 7, 2000, a slow-moving storm unleashed 15 inches of rain in Franklin and Jefferson Counties in less than 24 hours. The city of Union in Franklin County was among the hardest hit

due to extreme flooding from Flat Creek. In all, 10 counties were included in Presidential Disaster Declaration MO DR 1328, issued on May 12, 2000 (see **Figure 55**). Three counties were declared eligible for public assistance and individual assistance, and seven others were declared for individual assistance.

**Figure 54. Spring 1999 Flood and Storms**



**Figure 55. Spring 2000 Flood**



### Spring 2003

Flash flooding occurred on May 7th and 8th, and became a major flooding event across all of southern and central Missouri through the early afternoon of May 9th. In addition to the numerous road closures, bridges blocked by debris, evacuations of towns, campgrounds, parks, and moderate river flooding, many communities had their worst flooding in more than 10 years. In Howell County, the most significant damage occurred after the Warm Fork River washed out a portion of train track four miles southeast of West Plains, resulting in a train derailment. Four locomotives, each weighing 260,000 pounds, and 10 railroad cars were knocked off the tracks allowing diesel fuel to flow freely onto the ground. In addition to all of the flash flooding reports, river flooding became significant as all of the southern Missouri rivers rose above flood stage by the middle of May. Some of the rivers crested at levels equivalent to the 1993 flood event.

### Measure Of Probability And Severity

In terms of overall damage, Missouri's most severe single hazard is flooding. While the state averages some 26 tornadoes each year, damage is generally confined to small areas with few fatalities, if any. By contrast, flooding has resulted in more federal disaster declarations in Missouri than any other hazard in the past three decades. Prior to the Great Floods of 1993, Missouri received federal disaster declarations due to flooding in the spring of 1990, October

1986, June 1984, December 1982, August 1982 (Jackson County), April 1979, September 1977, July 1976, June 1974, and for extensive flooding in April 1973 and again in November 1973.

Missouri's vulnerability to flooding is greatly increased because it is subject to flooding from two principal sources: the Missouri River Basin and the upper Mississippi River Basin. Over one-third of the annual monetary losses due to flooding in the Missouri River Basin occur within the State of Missouri.

Flash flooding can occur virtually anywhere in the state experiencing an abundance of rainfall in a very short time span, as with the November 1993 flood disaster, and floods of 1998 and 1999. The backing up of tributary stream flows creates flooding problems along the Mississippi River, especially in the southern area of the state where the land tends to be very flat and at low elevations. Even though many flood control projects have been implemented and directly aid in flood prevention, the state is still flood prone due to its geography and location.

**Table 26** describes the National Weather Service's three response levels for alerting the public as to the danger of floods.

**Table 26, National Weather Service Flood Response Levels**

Response Level	Activity
Flood Watch	Flash flooding or flooding is possible within the designated area.
Flood Warning	Flash flooding or flooding has been reported or is imminent. Necessary precautions should be taken at once.
Flood Advisory	Flooding of small streams, streets, and low-lying areas, such as railroad underpasses and urban storm drains, is occurring.

*Source: National Weather Service*

The threat of flooding is more likely in the spring, when late winter or spring rains, coupled with melting snow, fill river basins with too much water too quickly. Spring also represents the onset of severe weather in the form of thunderstorms, tornadoes, and heavy rains, which can generate flash flooding along these storm fronts. However, as demonstrated by the disaster declarations in December 1982 and the Great Summer Flood of 1993, severe flooding can occur in Missouri at any time of the year. Based on this information, the State rates the probability and severity of floods as high.

### **Impact Of The Hazard**

The Federal Emergency Management Agency estimates that more than 216,000 households are within designated floodplains in Missouri. In addition, thousands of other Missouri residents are at risk to the dangers of flash flooding from rapidly rising creeks and tributaries, storm water runoff, and other similar flooding events. Nationwide, most flood deaths are from flash floods, and nearly half of these fatalities are auto related, according to the National Weather Service.

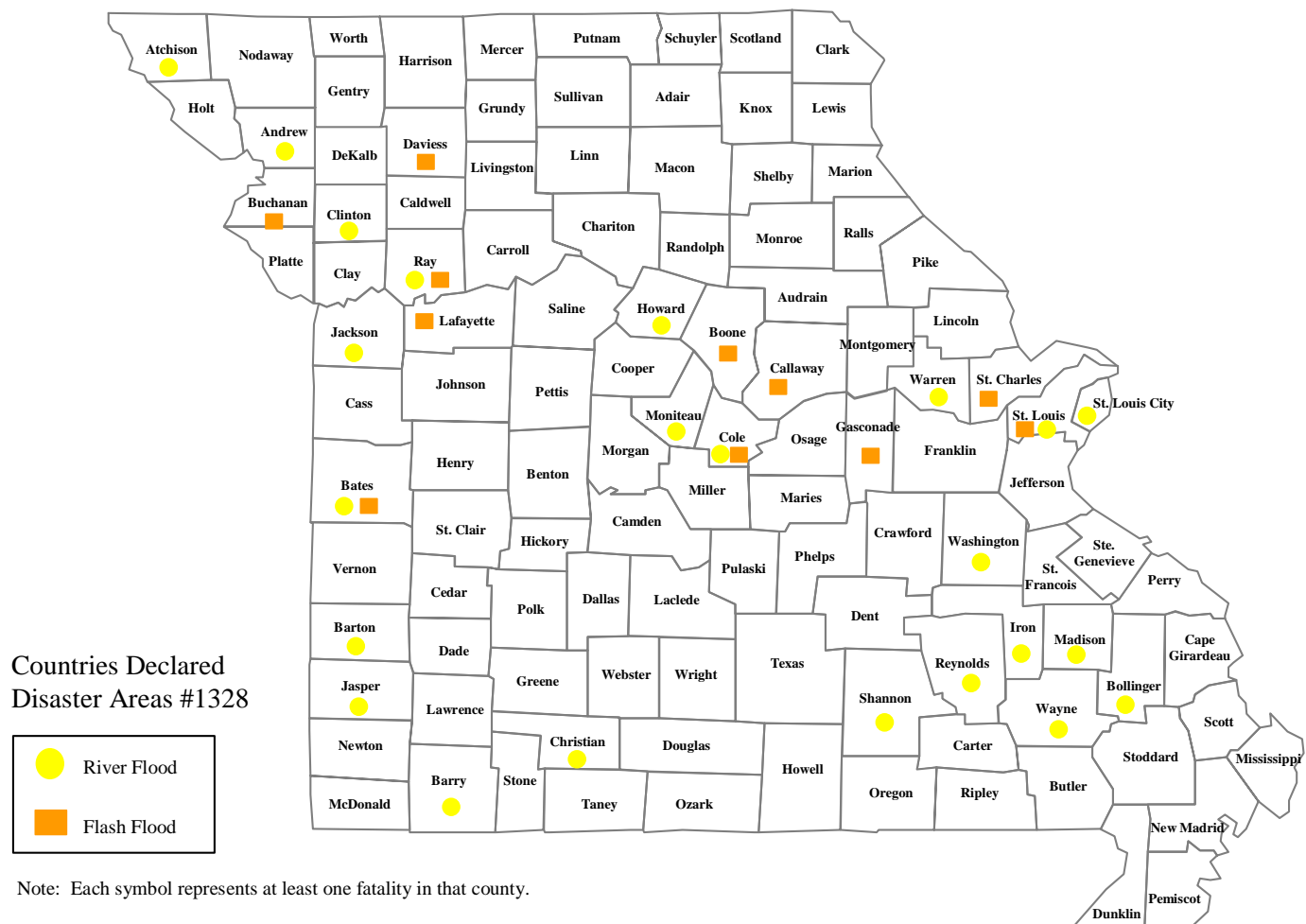
Of the 49 deaths recorded during the floods of 1993, 35 (71 percent) were from flash floods. In that same category, 20 deaths (77 percent) were related to motor vehicles caught in flash floods. Missouri's river flooding in 1993 claimed 14 lives, with 6 deaths (23 percent) attributed to motor vehicles. See flood-related mortality charts and maps in **Table 27** and **Figure 56**.



**Table 27. Summer/Fall 1993 Causes Of Death By Type Of Flood**

	River Flood	Flash Flood	Total
Motor Vehicle	6 (23%)	20 (77%)	26 (53%)
Drowning	5 (25%)	14 (74%)	19 (39%)
Electrocution	1 (50%)	1 (50%)	2 (4%)
Cardiac	2 (100%)	0	2 (4%)
All Causes	14 (29%)	35 (71%)	49 (100%)

**Figure 56. Flood-Related Mortality, Missouri 1993**



Missouri flood disasters have inflicted tremendous loss in terms of damage to personal property, businesses, infrastructure/public property, and agriculture. Total losses during the 1993 flood disasters were estimated at approximately \$3 billion. In addition, agricultural losses were estimated at \$1.8 billion, as 3.1 million acres of farmland were either damaged or went unplanted because of the 1993 rains. The Department of Agriculture estimated that 445,000 acres of Missouri River bottomland were destroyed by washouts and sand scouring. While levees designed to protect up to 50-year floods did their jobs, the amount of rain and up-river flooding

took their toll. Of the 1,456 public and private levees in the state, approximately 840 were damaged.

Almost every Missourian was at some time affected by the 1993 floods through inundation of roadways, airports, and drinking water and sewage treatment facilities, and by loss of income. The Missouri Department of Labor and Industrial Relations reported that \$6.2 million was disbursed for disaster unemployment assistance for people who lost work due to flooding from July 1993 through March 1994.

The floods of 1993-94 pointed out that too many Missourians were living in a floodplain. To rebuild in the floodplains, those whose homes sustained substantial damage (50 percent or more) were required to elevate the structures above the base flood level to protect from future flood damage. Under Missouri's Community Buyout Program, more than \$30 million in federal money was committed to moving Missourians voluntarily out of the floodplains through the acquisition of primary residential properties. As a result of those actions, it is estimated that state taxpayers will save more than \$200 million in future flood disaster claims.

### **Synopsis**

Flood events are often accompanied by other types of severe weather, including tornadoes, lightning, and severe thunderstorm activity. These storms also present a danger to life and property, often resulting in many injuries, and in some cases, fatalities. Floodwaters themselves often interact with hazardous materials. This has prompted the evacuation of many citizens near such materials stored in large containers that could break loose or puncture as a result of flood activity. Such events occurred during the 1993 flood, when approximately 11,000 St. Louis residents residing near flood-threatened propane tanks were evacuated on July 30. Evacuations were also ordered on July 31, when bulk propane tanks were flooded by the River Des Peres in St. Louis County. Federal and state agencies retrieved more than 247 large storage tanks; 1,178 small tanks; 3,470 large drums (over 15 gallons); and 5,731 small drums that had been swept away by the floods.

Public health concerns that may result from flooding include the need for disease and injury surveillance, community sanitation to evaluate flood-affected food supplies, private water and sewage sanitation, and vector control (for mosquitoes and other entomology concerns).

River Basin and Floodplain Maps are on file at the State Emergency Management Agency.

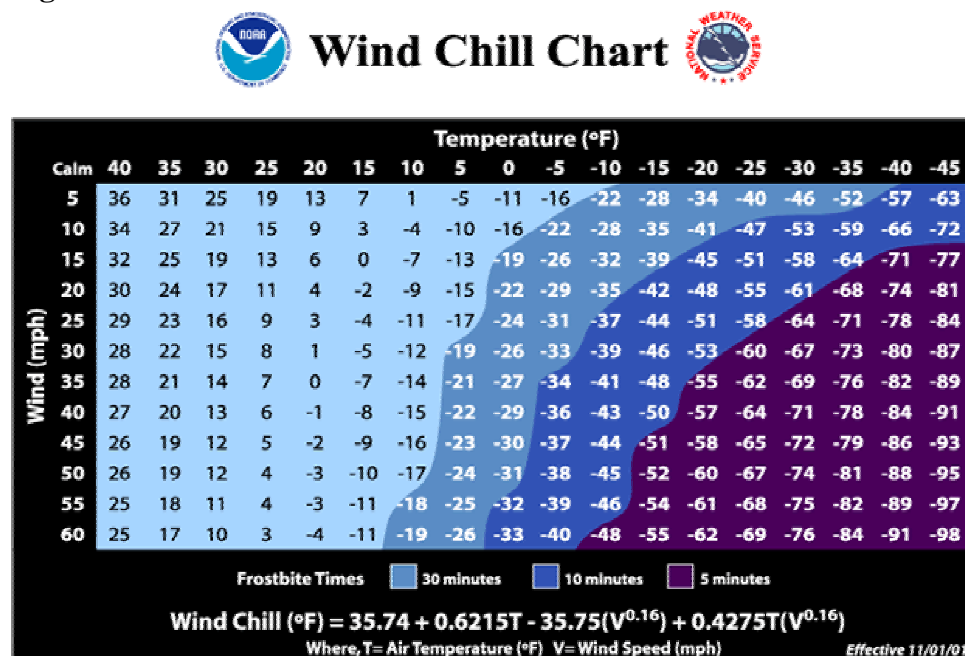
## **3.2.13 Severe Winter Weather (Snow, Ice and Extreme Cold)**

### **Historical Statistics**

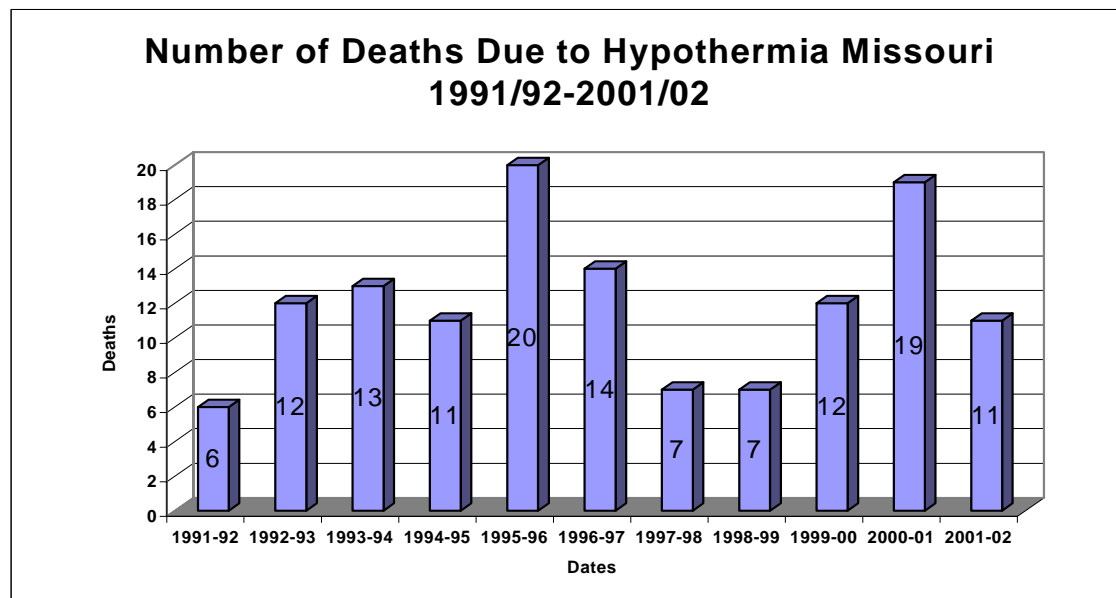
Weather data indicates that the Missouri counties north of the Missouri River receive an average annual snowfall of 18 to 22 inches, while counties south of the Missouri River receive an annual average of 8 to 12 inches. The events that involve borderline conditions of freezing rain and ice are highly unpredictable. The durations of the more serious events combined with other factors, such as high winds, are also highly unpredictable. The degree of severity may be localized to a small area due to a combination of climatic conditions.

Besides snow and ice, extremely cold temperatures can produce problems. The wind chill is determined from cold temperatures combined with air temperature (see **Figure 57**). For example, when the temperature is 20°F and the wind speed is 15 mph, the resulting wind chill is 6°F. This type of situation can be dangerous to people outdoors because their bodies can experience rapid heat loss and thus cause hypothermia (abnormally low body temperature). Statistical information regarding hypothermia mortality is provided in **Figure 58**.

**Figure 57. Wind Chill Chart**



**Figure 58. Number of Deaths Due to Hypothermia in Missouri (1991-1992, 2001-2002)**



*Source: Missouri Department of Health and Senior Services*

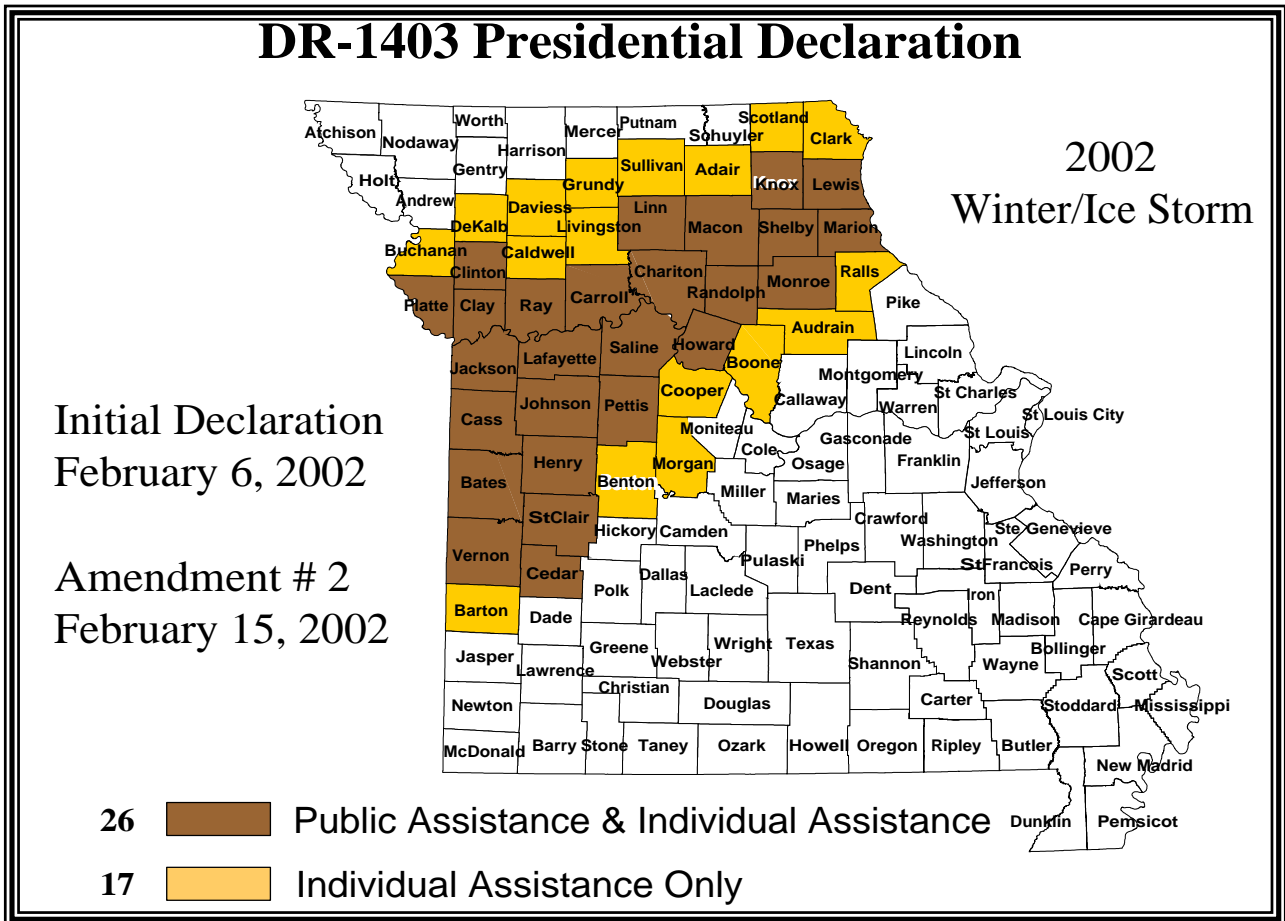
An indirect winter hazard that affects Missourians every year is carbon monoxide poisoning. Improperly vented gas and kerosene heaters or the indoor use of charcoal briquettes creates dangerous levels of carbon monoxide. In 1997, 31 cases of carbon monoxide poisoning were reported in Missouri. No deaths were reported from these cases.

The following summaries describe some of the more severe winter weather that has occurred in Missouri in recent years. (This information was taken from the National Weather Service's "Storm Data and Unusual Weather Phenomena" publication.)

- February 15-16, 1993: Central and southern Missouri was covered with up to 21 inches of snow. The airport at Cape Girardeau received 6 inches of snow in 1 hour and 20 minutes.
- January 14-20, 1994: Northeast, central, and east-central Missouri experienced overnight low temperatures from below zero to  $-20^{\circ}\text{F}$ . Hundreds of homes and businesses had frozen and busted water pipes. Wind chills, which ranged from  $-30$  to  $-50^{\circ}\text{F}$ , kept schools closed and accounted for 15 people being admitted to local hospitals for hypothermia and frostbite.
- January 16-17, 1994: A layer of ice up to 2 inches thick formed over sections of southeast Missouri, followed by 6 to 10 inches of snow. Some areas were without power for more than 24 hours. Roofs collapsed due to the heavy weight of snow and ice.

- December 6, 1994: Ice accumulations of 0.5 to 1.0 inch were reported across northwest, north-central, and northeast Missouri. Over 75 percent of the residents in this region were without power. Phone and cable television was also out. A few rural areas were without power for at least seven days. The City of St. Joseph was declared a disaster area by Governor Mel Carnahan because of damages totaling nearly \$4 million.
- January 18-19, 1995: Central Missouri received heavy snows, dumping 19.7 inches over Columbia alone and setting a new 24-hour snowfall record. Parts of I-70, I-44, and other major highways were closed due to drifting snow. Snow fell at such a fast rate that snowplows and graders became stuck. Almost 5,000 birds were killed when several large chicken and turkey barns collapsed. Thousands of people were without power and telephone service. The Jefferson City and Columbia airports were closed for a time. The University of Missouri at Columbia canceled classes for the first time in nearly 17 years. State offices in Jefferson City were also closed.
- October 22-23, 1996: An early snowfall hit the Kansas City area, dumping as much as 8.5 inches of heavy wet snow. Approximately 130,000 residences were without power, and an estimated \$1.5 million in property damages were reported.
- January 10-13, 1997: Northwest and west-central Missouri experienced overnight low temperatures below zero. No record low temperatures were recorded, but winds gusting up to 30 mph produced afternoon wind chills as low as -30 to -50 °F.
- April 10-11, 1997: A spring snowstorm dumped up to 24 inches in extreme north Missouri. Schuyler County alone reported \$2 million in damages, most due to the heavy snow causing roofs on farm buildings to collapse.
- January 31, 2002: A massive severe winter storm system dumped snow and ice from Oklahoma to Kansas and into central and northern Missouri. In Missouri alone, more than 600,000 residents were without power, as ice-encased power lines snapped in fierce winds or were pulled down by falling trees and limbs. Loss of electricity included more than 460,000 people in the Kansas City metro area alone (Jackson, Cass, Clay, and Platte counties). Additionally, residents in a line from Kansas City to the Iowa-Illinois border were without power as rural electric cooperative lines broke as well. Outages ranged from several days to nearly two weeks. Damage to property, power restoration, and the cost of debris removal for local governments was so high that Missouri received a presidential disaster declaration (MO-DR 1403) on February 6, 2002, which ultimately included 43 counties; 26 were designated for both individual and public assistance, and 17 were eligible for individual assistance only. See **Figure 59** for a list of all counties declared. The total eligible public assistance costs for this disaster (\$61.9 million dollars as of August 2002) ranks the 2002 ice storm as Missouri's second most costly disaster to date.

**Figure 59. Winter/Ice Storm 2002**



### **Measure Of Probability And Severity**

It is quite difficult to make an objective and quantitative measure of the probability and severity of snowstorms, ice storms, and extreme cold. Therefore, any analysis should be considered subjective and qualitative.

For areas north of the Missouri River, the probability of a snowstorm, ice storm, or extreme cold should be considered high due to historically higher average snowfall and lower average temperatures. However, the severity is rated moderate due to the overall level of preparedness in this area. For example, homes and businesses may be better insulated due to the higher probability of severe cold relative to other areas. Also, people living in this area may be more likely to use snow tires or purchase four-wheel-drive vehicles. People living in this area may be more likely to maintain adequate supplies of home heating fuels and consider other preparedness measures. Local and state governments may have access to more snow clearing equipment and maintain adequate supplies of materials needed for snow or ice removal. School districts and businesses may be more likely to develop and use snow routes or establish closing procedures.

Areas south of the Missouri River have a low probability of a snowstorm, ice storm, or extreme cold due to their lower average snowfalls and temperatures. However, such events in these areas have a moderate potential severity. This may be due to a lower level of preparedness. People living in this area may have homes with inadequate insulation or fail to maintain an adequate supply of home heating fuels. People may be less likely to equip their vehicles with snow tires or purchase four-wheel-drive vehicles. Local and state governments may not maintain sufficient amounts of equipment and materials. Schools and businesses may not have formal snow routes or closing procedures.

### **Impact Of The Hazard**

People are adversely affected by winter storms, ice storms, and extreme cold, some more than others. Observations by the National Oceanic and Atmospheric Administration (NOAA) indicate that of winter deaths related to exposure to cold, 50 percent were over 60 years old, over 75 percent were male, and about 20 percent occurred in the home. Of winter deaths related to ice and snow, about 70 percent occur in automobiles, and 25 percent are people caught in storms. As noted earlier, ice storms can result in significant economic costs to homeowners, business owners, and utility companies. The ice storm in December 1994 has shown the environmental damage that can occur. Thousands of trees and plants were cut down or damaged as a result of the ice storm. The problem of debris clearance caused environmental impacts due to the permitted burning of debris or reduced landfill space.

### **Synopsis**

As noted in this report, snowstorms, ice storms, and extreme cold can interact to cause many hazards. Only a few degrees may be the difference between rain, ice, or snow. Duration and intensity of any of these events will determine the overall impact of a particular event. Wind speed may be the difference between a minor snow and a blizzard. These events cannot be prevented. Preparedness for these events may be the greatest single factor to reduce loss of life, injury, and property damage. NOAA weather broadcasts via radio and television provide important information for people to prepare and thus reduce risks to their lives and property.

**Fatalities from Hypothermia:** Hypothermia became reportable by law in Missouri effective April 8, 1993. Hypothermia is defined as a physician-diagnosed case of cold injury associated with a fall of body temperature to less than 94.1°F and resulting from unintentional exposure to a cold environment.

From 1991 through 2002, 132 Missourians died from conditions related to excessive cold. The most severe winters were 1995-96 when 20 deaths occurred, and 2000-2001 when 19 deaths were recorded (see **Figure 57**). Fifty-two percent of the total hypothermia deaths occurred in persons aged 65 and over. The rate of mortality increased sharply at older ages. This emphasizes the need to provide support and assistance to persons at highest risk.

**New Wind Chill Chart:** In 2001, the National Weather Service implemented a replacement Wind Chill Temperature (WCT) index for the 2001-2002 winter season (see **Table 28**). The reason for the change was to improve the current WCT index used by the NWS and the Meteorological Services of Canada (MCS, the Canadian equivalent of the NWS), which was based on scientific research and a previous index from 1945.

The new formula makes use of advances in science, technology, and computer modeling to provide a more accurate, understandable, and useful formula for calculating the dangers from winter winds and freezing temperatures. In addition, clinical trials have been conducted, and the results of those trials have been used to verify and improve the accuracy of the new formula. The new WTC index incorporates the following factors:

- Uses wind speed calculated at the average height (5 feet) of the human body's face, instead of 33 feet (the standard anemometer height);
- Is based on a human face model;
- Incorporates modern heat transfer theory (heat loss from the body to its surroundings during cold and breezy/windy days);
- Lowers the calm wind threshold to 3 mph;
- Uses a consistent standard for skin tissue resistance; and
- Assumes the worst-case scenario for solar radiation (clear night sky).

### **3.2.14 Special Events**

#### **Historical Statistics**

##### **Atlanta, Georgia, Centennial Olympic Park Bombing**

On Saturday July 27, 1996, Georgia Bureau of Investigation (GBI) agents in Atlanta were dispatched to the Centennial Olympic Park for what seemed like a routine public disturbance call on the ninth day of the 1996 Summer Olympics. Apparently, some rowdy party-goers had been creating a scene at the event.

By the time GBI agents arrived, the parties were gone. However, a security guard pointed out another problem: a green knapsack left unattended under a nearby bench. Because of the suspicious nature of the situation, a bomb diagnostic team was called as officers attempted to keep people away from the area without creating a panic. They were unaware that a warning call had been made to 911 emergency dispatchers.

About 20 minutes later, as agents were assessing the situation and continuing to attempt to steer people away from the abandoned bag, it blew up with a powerful explosion. The blast killed one visitor and injured more than 100. All of the law officers at the scene were injured except for one. A Turkish cameraman also died of a heart attack while covering the explosion.

FBI said of this incident, "The fatal bombing in Atlanta was a terrorist attack aimed at thousands of innocent persons gathered at the Olympic Park." This blast was the worst attack on an Olympic Games since 11 Israeli athletes were killed by Palestinian guerrillas at the 1972 Games in Munich, Germany.

##### **St. Louis, Missouri, Papal Visit**

Pope John Paul II visited St. Louis, Missouri, on January 26 and 27, 1999. This pastoral visit included 30 hours of speeches, parades, prayer services, and a papal Mass for about 104,000 people at the St. Louis America's Center, which filled every available seat in the center, including the Edward Jones Dome and adjoining convention exhibit hall. This Mass is billed as the largest U.S. indoor gathering ever.



This 2-day series of events also included a welcome address by President Clinton and ceremonial farewell meeting with Vice-President Al Gore, and was attended by many state officials including Missouri Governor Mel Carnahan. Event activities were spread throughout the St. Louis metropolitan area, from the Lambert-St. Louis International Airport to the downtown area and the grounds of the Gateway Arch on the Mississippi Riverfront.

This was undoubtedly the largest single “special event” to occur in the State of Missouri in recent years, with security concerns reaching to national and international levels. Close coordination between local, state, and federal law enforcement agencies is required to provide adequate security measures for events like this. The potential for hazards from mass transportation accidents was also elevated for this event, as one quote said, “Seemingly every school bus in the region was enlisted to transport people from suburban pickup points down into St. Louis America’s Center for the papal Mass”. Fortunately, this event was conducted without any major incidents.

### **St. Louis, Missouri, World Agricultural Forum Conference**

The Hyatt Regency Hotel at Union Station in St. Louis hosted the “World Congress” meeting of the World Agricultural Forum May 18 to 20, 2003. The forum brought together agriculture industry leaders and world leaders to discuss the future of global agriculture. Mindful of Seattle, Washington’s, experience with violent protestors who disrupted the World Trade Organization (WTO) meeting there in December 1999, St. Louis police were braced for any possible problems that could arise from hundreds or even thousands of protestors descending on St. Louis for this event.

Four Seattle police officers were invited to St. Louis to talk about what happened at the 1999 WTO event, when 50,000 demonstrators overwhelmed 400 Seattle officers. Protestors smashed windows and vandalized cars as police fought back with rubber bullets and tear gas. Washington, D.C., police were also invited to St. Louis to share their experiences with riots during protests of major global conferences in their city.

Although St. Louis police were not anticipating the same level or intensity of violence as in Seattle, they did have intelligence reports that some visitors would be in St. Louis who were involved in the Seattle protests and other demonstrations. Another conference, called Biodevastation 7, was scheduled immediately prior to the World Agricultural Forum (May 16 to 18, 2003) in St. Louis, which involved a gathering of opponents to genetic engineering. An organizer with the group had indicated that 200 to 800 people were expected to attend the Biodevastation 7 conference and that there would be 200 to 2,000 protestors at the World Agricultural Forum.

During this time period, in nearby Creve Coeur, Missouri, extra police were also on hand at the Monsanto property for the annual Creve Coeur Days. Monsanto, an agriculture industry leader, is a host of the annual celebration, which includes carnival rides and game booths on its property. Creve Coeur police coordinated a plan with St. Louis police to gather information about possible protests at this event.

A local international security consulting firm was in charge of security for the World Agricultural Forum conference. They worked with St. Louis Police and other law enforcement agencies to prepare for possible protests at this event. Close coordination between these agencies helped to ensure that St. Louis was prepared to provide adequate security for the event and the international visitors to the city. Other than a couple of minor incidents between police and activists in the days leading up to the conference, no incidents were reported. A protest outside the conference on May 18 drew only a few

hundred demonstrators, all peaceful, and only a handful of demonstrators were present during the event's final two days.

### **Measure Of Probability And Severity**

Missouri will undoubtedly host future special events, which will require significant security and other emergency planning considerations. The overall probability that a disastrous incident from any cause would occur in conjunction with a designated special event or special security event is considered low to moderate. The probability for an incident to occur during any particular special event is really a function of the hazards previously detailed in this Missouri Hazard Analysis and the probability of the independent occurrences of these hazards. However, "special events" will unfortunately continue to be likely targets for protests, rioting, and terrorist attacks in the U.S. Refer to the Measure of Probability and Severity discussions in the previous annexes of this document for more specific considerations.

The severity of incidents occurring in conjunction with designated special events could range from low to high, depending on many factors. The severity of these incidents will be a function of the number of people attending these events and the type and severity of the specific hazards to affect the events. Considerations of severity could range from a "hoax" bomb scare or terrorist threat where no one is physically injured and without any property damage, to a full-scale disaster affecting a large number of people gathered at one time with mass injuries and property damage by natural, accidental, or terrorist or criminal causes. Refer to the Measure of Probability and Severity discussions in the previous annexes of this document for more specific considerations.

### **Impact Of The Hazard**

As with the measure of probability and severity, the potential impact of hazards occurring in association with any special event must be evaluated as a function of the specific hazard that could cause the impact on a large number of people attending any event. Refer to the Impact of the Hazard discussions in the previous annexes of this document for more hazard-specific impact considerations. Certainly the potential impact of any hazard can be multiplied several-fold when it affects a large number of people all at once.

### **Synopsis**

Adapted from the new National Response Plan (NRP), "Initial Plan Draft": The perception of inherent dangers and complex threats facing this country and the potential consequences they could have on the American way of life has changed significantly since the terrorist attacks of September 11, 2001. These threats cross a broad spectrum of contingencies from acts of terrorism to natural disasters to other man-made hazards (accidental or intentional). Because all carry the potential for severe consequences, these threats must be addressed with a unified national effort. A new paradigm for incident management is required. This philosophy has been the mandate for change leading to development of the NRP.

This section is being added to the Missouri Hazard Analysis (Appendix 5 to the State Emergency Operations Plan) in keeping with the new framework of the NRP. The new NRP is being designed as an "all hazards/all disciplines" plan and considers hazards under the full range of possible contingencies, including:

- Natural Disasters
- Accidents
- Civil/Political Incidents

- Terrorist/Criminal Incidents
- Significant Events/Designated Special Events.

Significant events or “designated special events” are considered any type of event where large groups of people are gathered and expanded security and other resources are required above and beyond the resources typically available to local or state government. Special events may be motivated by political, economic, or social causes, as in the case of Inaugural Ceremonies, State of the Union Addresses, and Summit Conferences, or they may be motivated by recreational causes as with major sporting events or designated holiday events.

Regardless of the purpose or cause, special events will place a large number of people in one area at one time. Anytime people are crowded together in one place, an incident resulting from just about any of the hazards detailed in this Missouri Hazard Analysis could have compounded and devastating impacts. In such instances, event sponsors, in conjunction with local and state authorities, are responsible for coordinating the event and requesting assistance at the federal level, if necessary.

Local and state authorities are responsible for:

- Coordinating requirements from the organization sponsoring an event; and
- Determining resource shortfalls and submitting resource requests, through the existing structures and mechanisms, to the national level for consideration.

Event sponsors are responsible for:

- Developing concepts for conducting the event;
- Identifying resource requirements necessary to support the event; and
- Submitting resource requests to local and state governments for consideration.

### 3.2.15 Terrorism

#### Historical Statistics

The following section highlights noteworthy terrorist-related threats and actual attacks that have occurred in the United States since 1970.

- In 1972, members of a U.S. fascist group called Order of the Rising Sun were found in possession of 30 to 40 kilograms of typhoid bacteria cultures, which they planned to use to contaminate water supplies in Chicago, St. Louis, and other large Midwestern cities.
- In 1984, two members of an Oregon cult headed by Bhagwan Shree Rajneesh cultivated Salmonella bacteria and used it to contaminate restaurant salad bars in an attempt to affect the outcome of a local election. Although approximately 751 people became ill and 45 were hospitalized, there were no fatalities.
- In February 1993, an improvised bomb exploded in a rental van parked on the second level of the World Trade Center's parking basement. The bomb contained approximately 1,200 to 1,500 pounds of a homemade fertilizer-based explosive, urea nitrate. The blast produced a crater 150 feet in diameter and five floors deep. Although the motive for the attack was never confirmed, it is generally believed that the suspect who masterminded the bombing was either backed by a "loose network" of militant Muslims or directed by Iraq. He was arrested and sentenced to 240 years in prison. The incident, which killed six people and injured more than 1,000, was the most significant international terrorist act that had ever been committed on U.S. soil at that time.
- In April 1995, a massive bomb exploded inside a rental truck parked near the Murrah Federal Building in Oklahoma City, destroying half the nine-story building and killing 168 people. The incident was traced to Timothy McVeigh, who was convicted of the bombing and later executed by lethal injection in June 2001. He was the first federal prisoner to be executed in 38 years. McVeigh was a survivalist who believed individual rights were being deprived by government agencies (e.g. gun control). Consequently, he was convinced he acted to defend the Constitution and saw himself as a crusader and hero. This was the worst terrorist event, either domestic or international in origin, that had ever occurred in the U.S. at that time.
- In March 1995, four members of the Minnesota Patriots Council, a right-wing militia organization advocating the violent overthrow of the U.S. government, were convicted of conspiracy charges under the Biological Weapons Anti-terrorism Act of 1989 for planning to use ricin, a lethal biological toxin. The four men allegedly conspired to assassinate federal agents who served papers on one of them for tax violations.
- In May 1995, a member of the neo-Nazi organization Aryan Nations was arrested in Ohio on charges of mail fraud. He allegedly misrepresented himself when ordering three vials of freeze-dried Yersinia Pestis, the bacteria that causes bubonic plague, from a Maryland biological laboratory.
- In October 1995, the Amtrak Sunset Limited passenger train derailed near Hyder, Arizona. It was determined that the train track had been sabotaged, causing the train to derail and topple 30 feet from a bridge. A letter signed by the Sons of Gestapo was left at the scene. One person was killed and 83 others were injured in this incident.

- In November 1995, members of the Tri-States Militia (a group composed of militia from at least 30 states) were arrested after being linked to five would-be terrorists whose bomb plots were thwarted by federal and state law enforcement agencies. The plots involved blowing up the Southern Poverty Law Center, offices of the Anti-Defamation League, federal buildings, abortion clinics, and gay community locations.
- In December 1995, an Arkansas man was charged with possession of ricin in violation of the Biological Weapons Anti-terrorism Act. The man was arrested and subsequently hanged himself in his jail cell the next day.
- In July 1996, a pipe bomb exploded in Atlanta's Centennial Olympic Park as the city was hosting the summer Olympic Games. One person was killed and dozens were wounded. It was later determined that the bomb had been planted by Eric Robert Rudolph, who was also suspected of being responsible for a double bombing at the Sandy Springs Professional Building in Atlanta in January 1997 and a double bombing at The Otherside Lounge in Atlanta in February 1997. Rudolph was arrested in May 2003 after 5 years on the run. He is a former soldier and survivalist with extreme right-wing views and is also reported to have ties to white supremacist groups.
- At about 8:45 a.m. on September 11, 2001, a hijacked commercial airliner struck the North Tower of the World Trade Center in New York City. Shortly after 9:00 a.m., another hijacked aircraft crashed into the South Tower. Approximately 3,000 people were killed in the incident, and about 7,000 more were injured. Emergency responders entered the towers to assist with evacuation of the occupants and perform search and rescue and fire-suppression activities. The towers then collapsed, killing hundreds of responders, including top leaders of the Fire Department of New York City (FDNY) who had been in charge at the scene. A total of 450 responders were killed, including 23 from the New York City Police Department, 343 from FDNY, and 74 from the Port Authority of New York and New Jersey. Approximately 320 emergency responders were treated for injuries or illnesses at five nearby hospitals; others were treated at temporary triage stations. Responders and backup supplies were dispatched from all over the country, including 20 FEMA Urban Search and Rescue (USAR) task forces.

A second attack also occurred on September 11, 2001, when a hijacked airliner crashed into the western side of the Pentagon building in Washington, D.C., killing 125 people on the ground, as well as 64 people on the plane. Area hospitals treated 88 injured people. The crash damaged or destroyed three of the five interior concentric "rings" of the Pentagon building. The section where the plane hit had been recently renovated, and many offices were empty or were being used for storage at the time. Local responders arrived immediately, and other agencies, including five USAR teams, came to assist. The Arlington County Fire Department set up an incident command system and coordinated the emergency response. The rescue and recovery phase lasted 11 days, after which Arlington County transferred responsibility for the incident and site management to the FBI, on September 21, 2001. No responders were killed.

- Between early October and early December 2001, five people died from anthrax infection, and at least 13 others contracted the disease in Washington, D.C.; New York City; Trenton, New Jersey; and Boca Raton, Florida. Anthrax spores were found in a number of government buildings and postal facilities in these and other areas. Most of the confirmed anthrax cases were tied to contaminated letters mailed to media personalities and U.S. Senators. Thousands of people were potentially exposed to the spores and took preventive antibiotics. Numerous mail facilities and government buildings were shut down for investigation and

decontamination. In the wake of these incidents, federal, state, and local emergency response agencies across the United States responded to thousands of calls to investigate suspicious packages, unknown powders, and other suspected exposures. Almost all of these incidents turned out to involve no actual biohazard. Nevertheless, emergency responders typically treated each call as a potentially serious health and safety risk. During this tense time in Missouri, the Department of Health and Senior Services (DHSS) issued numerous Health Alert Advisories to local officials and the public, providing guidance on how to handle anthrax or other suspicious letters and packages during a time of extremely heightened tensions. DHSS also instituted a surveillance system, contacting health providers to obtain public health information twice weekly, while also working to improve the public health infrastructure, information sharing, health communication networks, and hospital surge capabilities.

### **Measure Of Probability And Severity**

The threat of terrorism in the United States remains a concern. Over the past few years, the level of acts committed in the U.S. has increased steadily. According to the FBI, two known or suspected terrorist acts were recorded in the U.S. in 1995, three in 1996, four in 1997, five in 1998, and 12 in 1999. In addition to the 12 acts in 1999, an additional seven planned acts of terrorism were prevented in the U.S.

Although several different extremist groups have been identified in Missouri, there have been no indications of any specific recent terrorist activities. The potential does remain, however, for new extremist and/or terrorist groups to move into the state at any time.

An open society such as ours, which depends on technology for its continued smooth operation, remains a potential target for terrorists. Large cities with a variety of news media outlets probably represent the most likely locations for terrorist acts because terrorists generally want their acts to reverberate in the news media and reach the largest audience possible. Since Missouri does not have large media markets compared to some states, it is not as likely a target for terrorist activity as those other states. However, the Oklahoma City bombing debunked the idea that rural America is completely safe from terrorists. With this in mind, it appears that a terrorist attack could occur in Missouri, but the probability of such an attack is low.

### **Homeland Security Advisory System**

Because of the potential for future terrorist-related incidents, a national security alert system was developed to disseminate information regarding the risk of terrorist acts to federal, state, and local governments and to the American people. This system, known as the Homeland Security Advisory System (HAAS), is based on five color-coded threat conditions, which are summarized in **Table 28**.

**Table 28. Homeland Security Advisory System Color Codes**

Color	Level of Threat	Description
Red	Severe	Severe risk of terrorist attack
Orange	High	High risk of terrorist attack
Yellow	Elevated	Significant risk of terrorist attack
Blue	Guarded	General risk of terrorist attack
Green	Low	Low risk of terrorist attack

Threat conditions are assigned by the Attorney General, in consultation with the Assistant to the President for Homeland Security. Threat conditions may be set for the entire nation or a particular geographic area or industrial sector. The assigned threat conditions are reviewed at regular intervals to determine whether adjustments are warranted. Missouri's State Emergency Management Agency (SEMA) is currently developing guidelines for implementing the HAAS at the local level, with recommended actions for each threat condition. When completed, those guidelines will be available on SEMA's website.

Should Missouri experience a terrorist attack, the severity of such an attack could range from high to low depending on the attack. For instance, if a building was blown up and no lives were lost, the severity of the attack would be low. However, if a terrorist group decided to contaminate a large urban area's water supply with a poisonous chemical, the severity of the attack could be very high due to the number of people directly affected by the poisoned water, as well as damage to that community's sense of well-being. An attack of this nature could easily result in mass hysteria and insecurity concerning the government's ability to protect its citizens.

### **Impact Of The Hazard**

As stated above, terrorist acts could easily undermine the confidence that people have in their own security and that of their government's ability to protect them from harm. For example, instructions to make bombs are readily accessible to potential terrorists (including via the Internet), and the materials for their construction are readily available. Because bombs can be made so easily, the threat of a bomb should not be taken lightly. Even the threat of a bomb can disrupt a community almost as effectively as an actual bomb, while creating far fewer risks for the persons making the threat. Therefore, no matter how large or small the incident, a terrorist act can have a major impact on a community.

### **Synopsis**

The trend toward high-profile, high-impact attacks has corresponded with growing concerns over the potential use of weapons of mass destruction. Between 1997 and 2000, the FBI investigated 779 WMD-related reports, generally involving individuals or small groups. The vast majority of these cases were found to be false or fabricated reports. The biological toxin ricin and the bacterial agent anthrax are emerging as the most prevalent agents involved in those investigations. In 2000, 90 of 115 biological threats investigated by the FBI involved the threatened use of anthrax. Given the potential for inflicting large-scale injury or death, the efforts of international and domestic terrorists to acquire WMD remains a significant concern and priority of the FBI.

A terrorist can attack a society in many ways. Therefore, people must prepare for such an incident. In the wake of the September 11, 2001, attacks, Missouri Governor Bob Holden appointed retired Colonel Tim Daniel as Special Advisor for Homeland Security, a cabinet-level position, on September 26, 2001. He cooperates with state departments, including the Department of Public Safety (which includes the State Emergency Management Agency, National Guard, and State Highway Patrol), as well as the Departments of Health and Senior Services, Agriculture, Transportation, Natural Resources, Social Services, Conservation, and Mental Health. In November 2001, Holden created the Missouri Security Council to assess homeland security needs within the state. The council oversaw a statewide vulnerability assessment, which is the basis for establishing priorities and for allocating resources. Missouri's other recent activities in counter-terrorism preparedness are summarized below.

- Security at the State Capitol and selected state office buildings has been increased with the introduction of access control and identification cards for all state employees.

- Members of the U.S. Attorney's General Working Groups and FBI-led Counter-Terrorism Task Forces have met in Kansas City and St. Louis.
- Missouri has worked with federal agencies to contact and provide security training to thousands of hazardous material vendors and transporters. The State Highway Patrol has increased surveillance of hazardous material transports on the highways and established a statewide intelligence and information-sharing database - the Missouri State Police Intelligence Network (MOSPIN).
- The Missouri General Assembly passed legislation to improve the ability of police to detect and prevent terrorism and for authorities to respond to medical emergencies, both natural and human-caused.
- St. Louis University's Center for Bioterrorism and Emerging Infections produced educational tools to help health care providers detect bioterrorism nationwide.
- The 7<sup>th</sup> Military Support Detachment (MSD) Civil Support Team (CST) at Fort Leonard Wood has enhanced its capabilities to assist local and state officials in responding to terrorist-related incidents involving WMD.

The SEMA Homeland Security Response Teams Map (**Figure 60**) indicates locations of 28 existing or proposed Homeland Security Response Teams for the State of Missouri. A few of these teams include hazardous materials response teams with enhanced capabilities for response to WMD incidents, including incidents involving nuclear or radiological materials, and biological and chemical agents. The SEMA Terrorism Program should be contacted to fully determine the capabilities of the Homeland Security Response Teams in specific areas.



**Figure 60. Homeland Security Response Teams**

Troop A -  
Kansas City  
Clay Co./Northland Fire  
Chiefs Assoc. (NFCA)  
Lee's Summit  
Sedalia/Pettis Co.  
City of Warrensburg, Johnson  
County (FRRT)  
Tri-District FPD

Troop B -  
Kirksville  
Hannibal (FRRT)

Troop C -  
St. Charles/Warren Co.  
St. Louis County  
St. Louis City  
Jefferson Co.  
Franklin Co.

Troop D -  
Springfield/Logan-Rogersville  
Joplin  
Nevada (FRRT)  
Taney Co./Branson

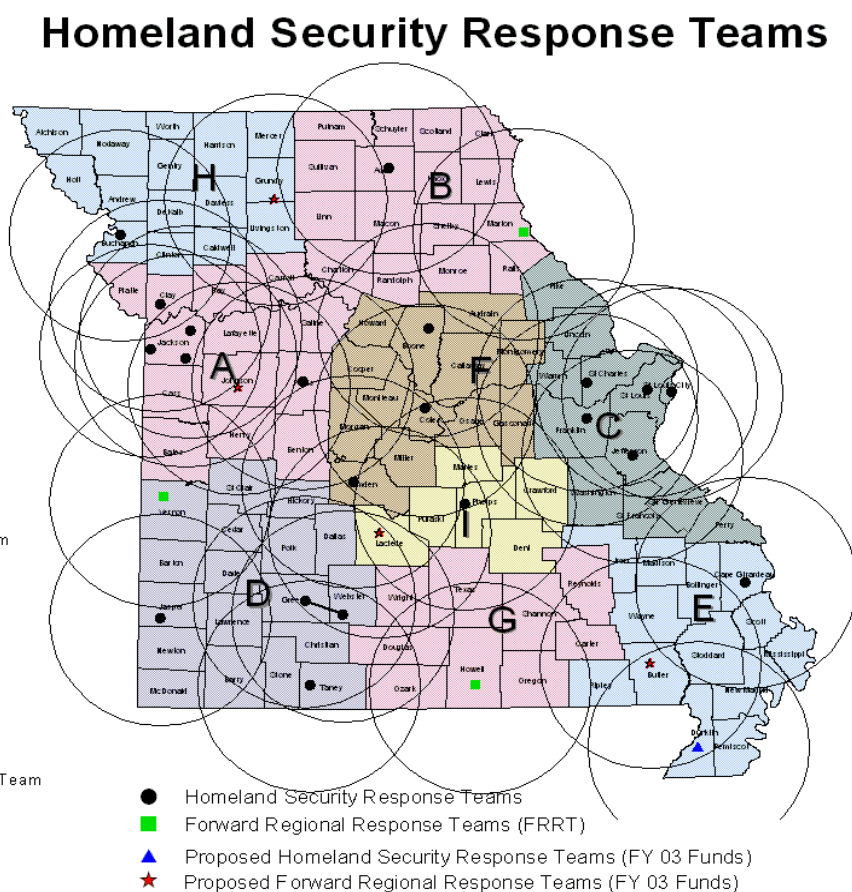
Troop E -  
City of Jackson/SEMO HazMat Team  
City of Poplar Bluff (FRRT)  
City of Kennett

Troop F -  
Columbia/Boone Co.  
Camden Co. HazMat Team  
Cole Co. HazMat Team

Troop G -  
West Plains (FRRT)

Troop H -  
Andrew Co./Northwest Mo. HazMat Team  
Grundy/Livingston County (FRRT)

Troop I -  
Rolla/Phelps Co.  
City of Lebanon (FRRT)



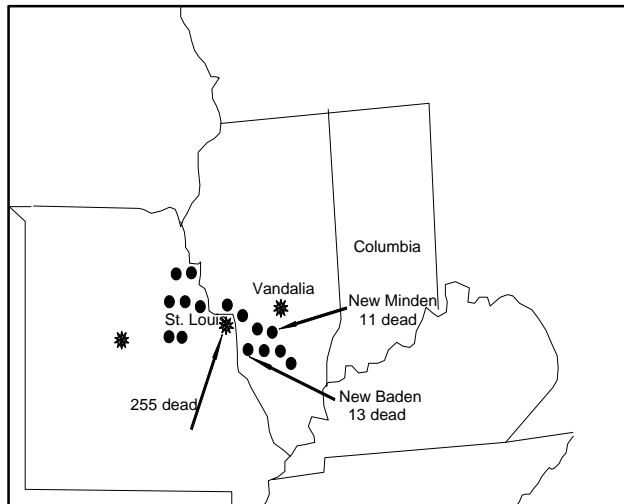
### 3.2.16 Tornadoes and Severe Thunderstorms

#### Historical Statistics

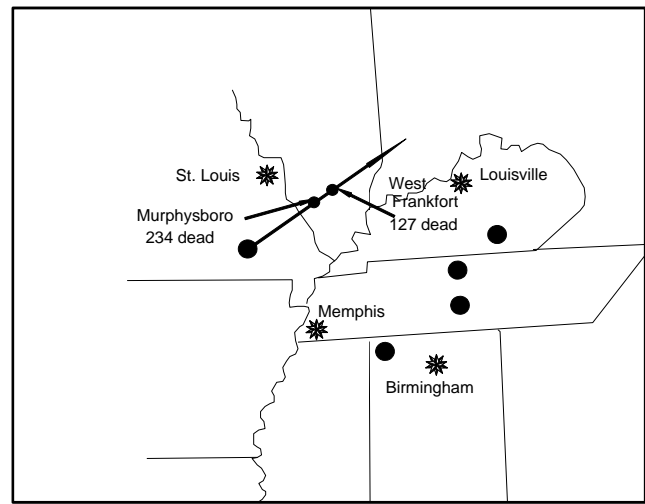
Historically, the State of Missouri has experienced numerous tornadoes of varied intensities. The National Weather Service reported that 1,400 tornadoes had occurred in Missouri from 1950 to 2002, with 160 deaths and over \$900 million in damages. This averages 26 tornadoes per year and 3 deaths per year. However, it is highly likely that additional tornadoes occurred that were not reported.

- On May 27, 1896, between the hours of 2 and 8 p.m., a series of 18 tornadoes known as the “St. Louis, Missouri, Outbreak” struck Missouri and Illinois. These tornadoes resulted in 306 deaths and \$15 million in damages (see **Figure 61**).
- The worst tornado in U. S. history, in terms of deaths and destruction, occurred in Missouri on March 18, 1925, between 1 and 6 p.m. (see **Figure 62**). The great “tri-state” tornado originated in Reynolds County. It proceeded east-northeast through the southern quarter of Illinois and into Indiana, covering 219 miles. It caused over \$18 million in damage, affected six states, and killed 689 persons.

**Figure 61.**  
**St. Louis, Missouri, Tornado Outbreak**



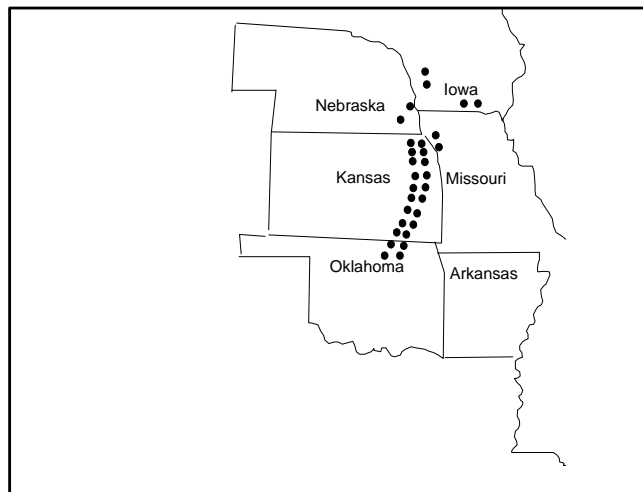
**Figure 62.**  
**The Great Tri-State Tornado of 1925**



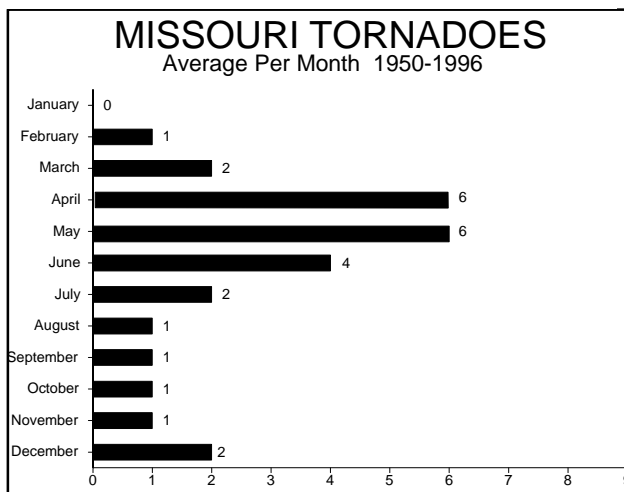
- The City of Poplar Bluff, Missouri, was almost wiped out by a tornado on May 9, 1927. This tornado cost 92 lives and \$2 million in damages. The same day, two severe tornadoes struck St. Louis, Missouri. The first tornado moved across the entire city from the western city limits to the Mississippi River through the Lafayette Park area, killing 306 people in Missouri and Illinois and causing almost \$13 million in damages. The second tornado started in the southwestern part of the city and proceeded through the Tower Grove and Vanderventer areas, then on to Granite City, Illinois. Seventy-nine people were killed, and about \$23 million in damages resulted from this storm.
- During the afternoon and evening of April 3, and the early morning of April 4, 1974, a “super outbreak” of 148 tornadoes across 13 states killed more than 300 people, injured more than 6,000 and caused \$600 million in damages (see **Figure 63**).
- On the afternoon of April 26, and the early morning of April 27, 1991, an outbreak of 54 tornadoes covering six states, including Missouri, resulted in 21 deaths, 308 injuries, and damages exceeding \$277 million. There were two deaths in vehicles and 15 deaths in and near mobile homes.
- On July 4, 1995, at approximately 5:40 p.m., a tornado struck the Randolph County community of Moberly. The initial touchdown of the storm was south of town. The storm then moved through the eastern half of the community. The tornado uplifted approximately 7 miles northeast of Moberly. At least 15 people were injured, 25 businesses damaged, along with the courthouse, and some 300 families affected. This resulted in a Small Business Administration disaster declaration for low interest loans. The tornado was characterized by the National Weather Service as a class F3 tornado.
- On May 4, 2003, many tornadoes erupted from the southwest portion of Missouri. These tornadoes produced three major damage tracks, killing one person in Liberal, three people in Stockton, and two people in Carl Junction. Tornado statistics for 2003 have yet to be added to the National Weather Service database.

**Figure 64** shows that tornadoes in Missouri occur most frequently between April and June, with April and May usually producing the most tornadoes. However, tornadoes can occur any time of the year, such as the storms that struck in St. Charles and Barry Counties in November 1988.

**Figure 63.**  
**The Tornado Super Outbreak in 1974**



**Figure 64.**  
**Average Tornado Occurrences**



**Table 29** lists the Missouri tornadoes that resulted in presidential disaster declarations since 1975.

**Table 29. Disaster Declarations For Missouri Tornadoes Since 1975**

Date	Incident Type	Counties Declared	Type Of Assistance
May 3, 1975	Tornadoes, High Winds, Hail	Caldwell, Newton, Macon, Shelby	PA & IA
May 7, 1977	Tornadoes, Flooding	Carroll, Clay, Lafayette, Ray, Cass, Jackson, Pettis	PA & IA
May 15, 1980	Severe Storms, Tornadoes	Pettis	IA Only
May 1986	Tornadoes	Scott, Mississippi, Cape Girardeau, Perry	SBA Loans
November 1988	Tornadoes	St. Charles, Barry	SBA Loans
July 1995	Tornadoes	Randolph, (City of Moberly)	SBA Loans
May 6, 2003	Tornadoes, Severe Storms, Flooding	Barry, Barton, Bates, Benton, Bollinger, Buchanan, Camden, Cape, Cass, Cedar, Christian, Clay, Clinton, Cooper, Crawford, Dade, Dallas, Dent, Douglas, Franklin, Knox, Gasconade, Girardeau, Greene, Henry, Hickory, Iron, Jackson, Jasper, Jefferson, Johnson, Laclede, Lafayette, Lawrence, McDonald, Miller, Monroe, Morgan, Newton, Osage, Perry Pettis, Phelps, Platte, Polk, Pulaski, Ray, St. Francois, St. Louis, Sainte Genevieve, Saline, Scott, St. Clair, Stoddard, Stone, Taney, Vernon, Washington, Webster	IA
May 6, 2003	Tornadoes, Severe Storms, Flooding	Bollinger, Crawford, Franklin, Gasconade, Knox, Maries, Miller, Oregon, Osage, Pulaski, Washington	PA

Notes: IA Individual Assistance PA Public Assistance SBA Small Business Administration

### **Measure Of Probability And Severity**

The United States has 10 times more tornadoes than any other nation in the world. Missouri averages 26 tornadoes per year, and has recorded 1,400 tornadoes from 1950 through 2002. Missourians have a high probability that tornadoes will continue to affect their lives. The natural phenomena that create tornadoes will continue to occur beyond our ability to control them.

The enormous power and destructive capability of tornadoes are beyond mankind's capability to control. The potential severity of effects from tornadoes will continue to be high. We will continue to experience deaths, injuries, and property damages from tornadoes. However, technological advances will facilitate earlier warnings than previously available. This, combined with a vigorous public education program and improved construction techniques, provides the potential for significant reductions in the number of deaths and injuries, as well as reduced property damage.

### **Impact Of The Hazard**

Every tornado is a potential killer, and many are capable of great destruction. Tornadoes can topple buildings, roll mobile homes, uproot trees, hurl people and animals through the air for hundreds of yards, and fill the air with lethal, windblown debris. Sticks, glass, roofing material, and lawn furniture all become deadly missiles when driven by tornado winds. In 1975, a Mississippi tornado carried a home freezer for more than a mile. Once, a tornado in Broken Bow, Oklahoma, carried a motel sign 30 miles and dropped it in Arkansas. Tornadoes do their destructive work through the combined action of their strong rotary winds and the impact of windblown debris. In the simplest case, the force of the tornado's winds pushes the windward wall of a building inward. The roof is lifted up, and the other walls fall outward. Until recently, this damage pattern led to the incorrect belief that the structure had exploded as a result of the atmospheric pressure drop associated with the tornado.

### **Synopsis**

Tornadoes are usually associated with severe thunderstorms, which by themselves possess destructive potential. Such storms most often occur in the spring and summer, during the afternoon and evenings, but can occur at any time. In addition to tornadoes, other hazards associated with thunderstorms include the following:

- Damaging winds
- Lightning and resulting fires
- Hail
- Heavy rains causing flash flooding.

The damaging winds of thunderstorms include downbursts, microbursts, and straight-line winds. Downbursts are localized currents of air blasting down from a thunderstorm, which induce an outward burst of damaging wind on or near the ground. Microbursts are minimized downbursts covering an area of less than 2.5 miles across. They include a strong wind shear (a rapid change in the direction of wind over a short distance) near the surface. Microbursts may or may not include precipitation and can produce winds at speeds of more than 150 miles per hour.

In May 1996, a Memorial Day weekend storm identified by the National Weather Service as a microburst caused more than \$10 million in damage to homes in Lee's Summit, Missouri. The storm destroyed at least 13 homes and damaged more than 100 others in several Lee's Summit subdivisions. The city also incurred a substantial cost for debris removal and cleanup activities resulting from this devastating storm.

Damaging straight-line winds are high winds across a wide area that can reach speeds of 140 miles per hour. Large hail can reach the size of grapefruit. Hail causes several hundred millions of dollars in damage annually to property and crops across the nation. In addition, lightning kills 75 to 100 people each year. During the period of 1992 through 1996, seven people died in Missouri as a result of lightning strikes, compared to two deaths from tornadoes during the same period. The thunderstorms associated with tornado development also contribute to the number one weather killer—flash floods. Flash flooding causes 146 deaths annually throughout the nation. During the period from 1992 through 2002, flooding and flash floods claimed the lives of 60 Missourians. Thunderstorms and severe winds claimed five lives over this same period.

The following charts and maps (**Figures 65 – 69** and **Table 30**) depict additional Missouri tornado information, generally for the period between 1950 and 2000:

Figure 65. Missouri Tornadoes By County: Top Twenty-Five – 1950-2003

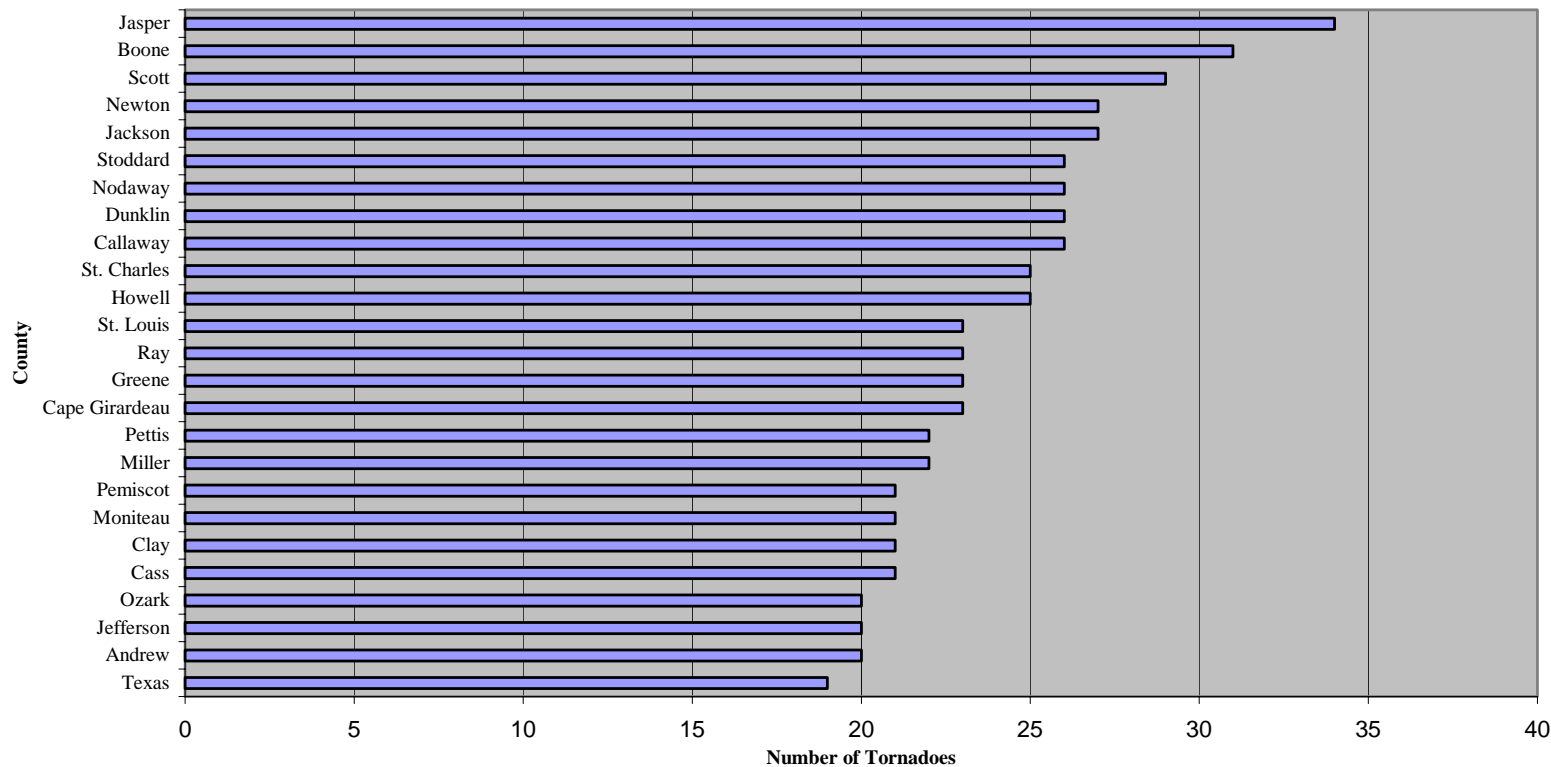


Figure 66. Missouri Tornadoes By County (1950-2003)

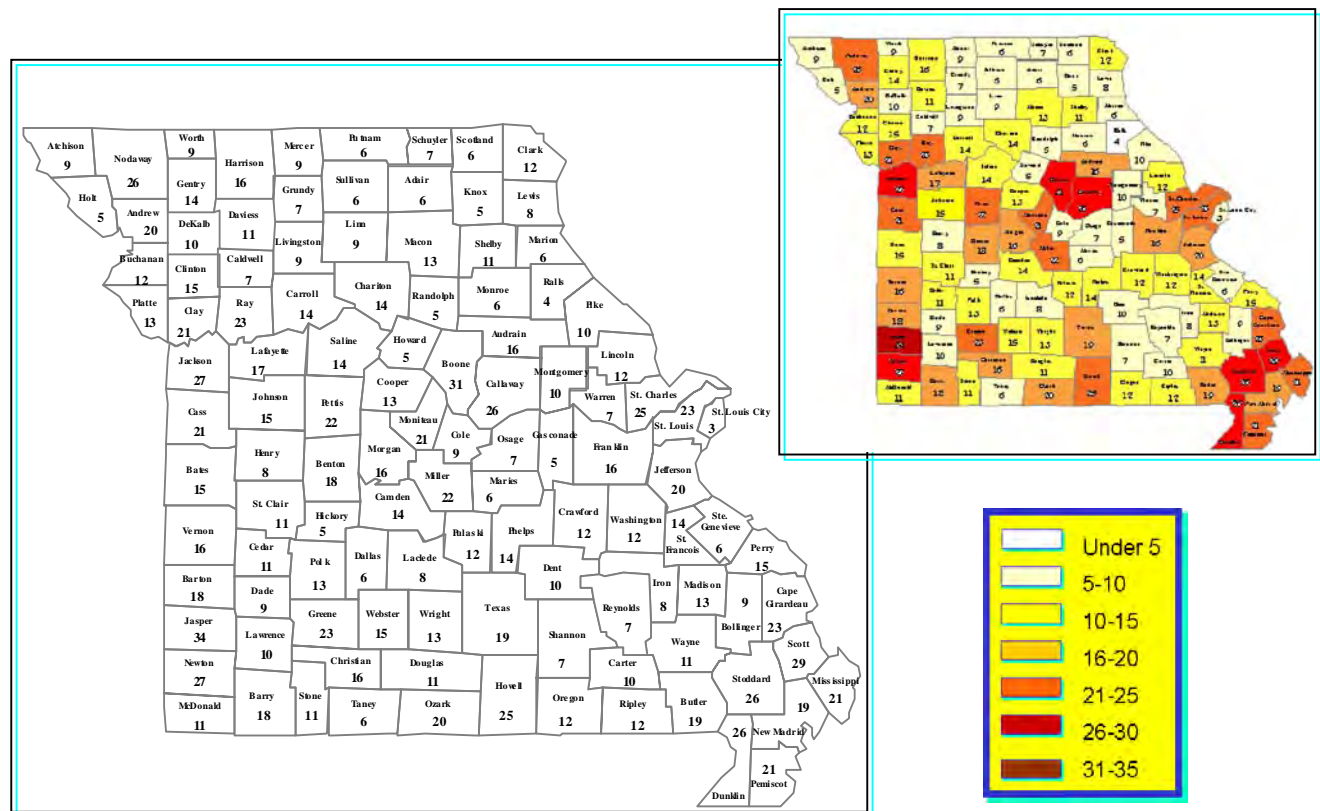


Figure 67. Missouri Tornado Deaths By County: Top Ten 1950-2003

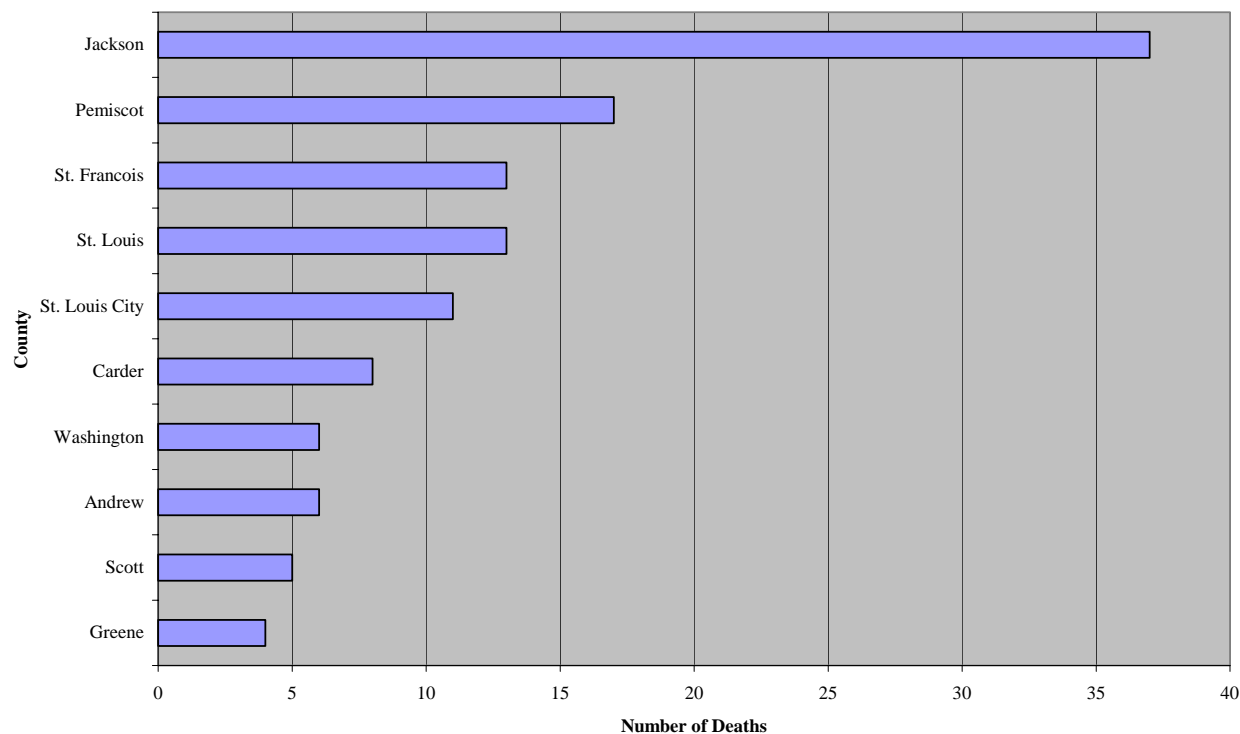


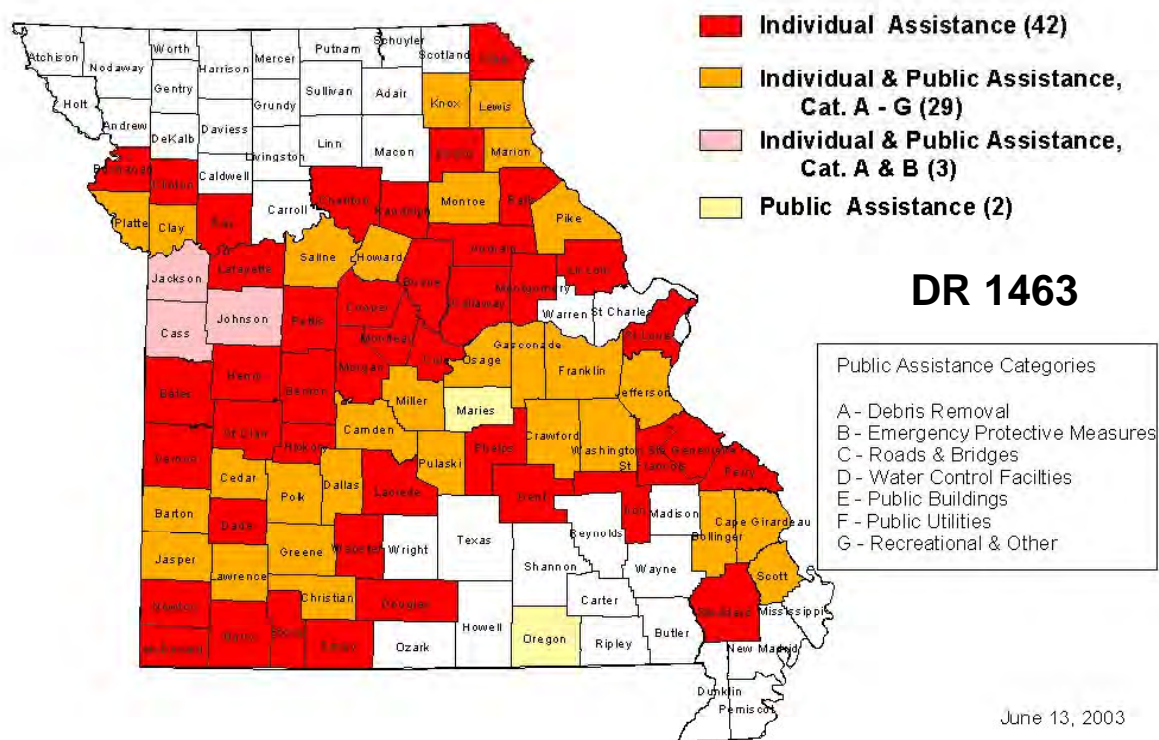
Figure 68. Missouri Tornado Deaths By County (1950-2003)



**Table 30. Missouri Tornado Statistics 1950 – 2002**

Total Number of Tornadoes	1,400
Total Number of Deaths	160
Total Number of Injuries	2,383
Yearly Average of Tornadoes	26
Yearly Average of Deaths	3
Yearly Average of Injuries	45
Tornado Deaths 1916 - 2002	620

**Figure 69. Spring 2003 Tornadoes**





### **3.1.17 Utilities**

#### **Historical Statistics**

Because utilities exist everywhere in the state, damage to utilities may occur frequently. This may be due to a backhoe cutting a buried line, an accident involving a motor vehicle, a flood or other severe weather. Many of these interruptions or failures go unreported to the Public Service Commission (PSC), and no definitive reporting system exists. Therefore, limited statistical information is available.

During the flood of 1993, telecommunications companies proved their adaptability by using cellular service to replace wire line service in areas where service could not be restored in a timely manner. One Local Exchange Company (LEC) utilized a trailer with cellular pay phones where the land lines were interrupted. Another company temporarily replaced analog subscriber carrier service with site-based cellular service. Short-haul portable microwave was also utilized to replace copper lines lost during the flood.

On January 30, 2002, a severe ice storm struck portions of western and northern Missouri, leaving devastation and darkened homes and businesses. Many news articles referred to this ice storm as the worst in Missouri's history. During the ice storm, ice accumulated on any object that was at or below freezing, and the weight of the ice broke utility poles, conductors, tree limbs and other objects that could not withstand the weight of the ice. Ice accumulations over an inch were reported in many areas. Many tree branches could not withstand the added weight of the ice and fell to the ground, striking whatever was in their path. Cars, homes, streets, properties, and electric power facilities were recipients of the falling trees and limbs. When the ice began to melt, the falling ice caused additional outages. Some electric customers experienced outages more than once during that period, as power was restored but interrupted again by falling limbs. At the peak of outages, over 400,000 customers were without power. Within three days, most of these customers were returned to service, but many customers in more heavily damaged areas were without power for over a week. Utilities affected by the ice storm quickly mobilized all of their available crews and sought outside assistance. Work crews from 16 different states came to western Missouri in an effort to rapidly restore power to as many customers as possible. For additional information about severe winter weather in Missouri, see Section 3.1.13.

#### **Measure Of Probability And Severity**

Because utilities exist throughout the state and are vulnerable to interruptions or failures, there is a high probability that this hazard may occur at anytime or anyplace throughout the state. In many cases, these are small isolated events, well within the capabilities of the local utility to address. Therefore, the degree of severity of these day-to-day events may be considered low. Due to long-range planning, regulation, and diligence of the utility operators, major interruptions resulting in a high degree of severity are few and far between. Recent regulatory, planning and structural initiatives designed to minimize interruptions and failures are listed below.

#### **Impact Of The Hazard**

Utility outages and interruptions can be very localized, or region-wide. Their greatest impact is generally upon the very young or elderly, who can be expected to have greater health risks associated with resultant loss of heating/cooling systems and with the loss of medical equipment that requires a power source. Loss of communications can also adversely affect the provision of emergency services, making it difficult to contact the services for emergency assistance. In addition, utility outages can

cause significant problems within the financial community, should there be a long-term loss of their data communications.

### **Communications**

During 1990, the Telecommunications Staff of the PSC requested that LECs submit plans for disaster recovery. Every LEC in the state submitted a plan that lists practices and procedures for any kind of disasters whether natural or human caused. The PSC has recommended to the telecommunication industry that in the event of an emergency, the various companies and emergency agencies should coordinate a single point of contact for emergency situations.

In order to mitigate the damage of earthquakes or other disasters, the LECs added bracing to all their central offices for their switching equipment and batteries. Since earthquakes or other disasters may affect electrical service, which is essential for operations, many companies have obtained on-site generators or made contingency arrangements to acquire them in the event of a disaster. For additional information regarding earthquakes in Missouri, see to Section 3.1.15. Such generators would be needed prior to exhaustion of emergency battery supplies, which may last about 8 hours. During the flood of 1993, one LEC provided emergency power to a central office, which was isolated by floodwaters. This was accomplished by driving a flat bed truck through the water with a diesel generator mounted on the bed. The generator was then fueled by boat.

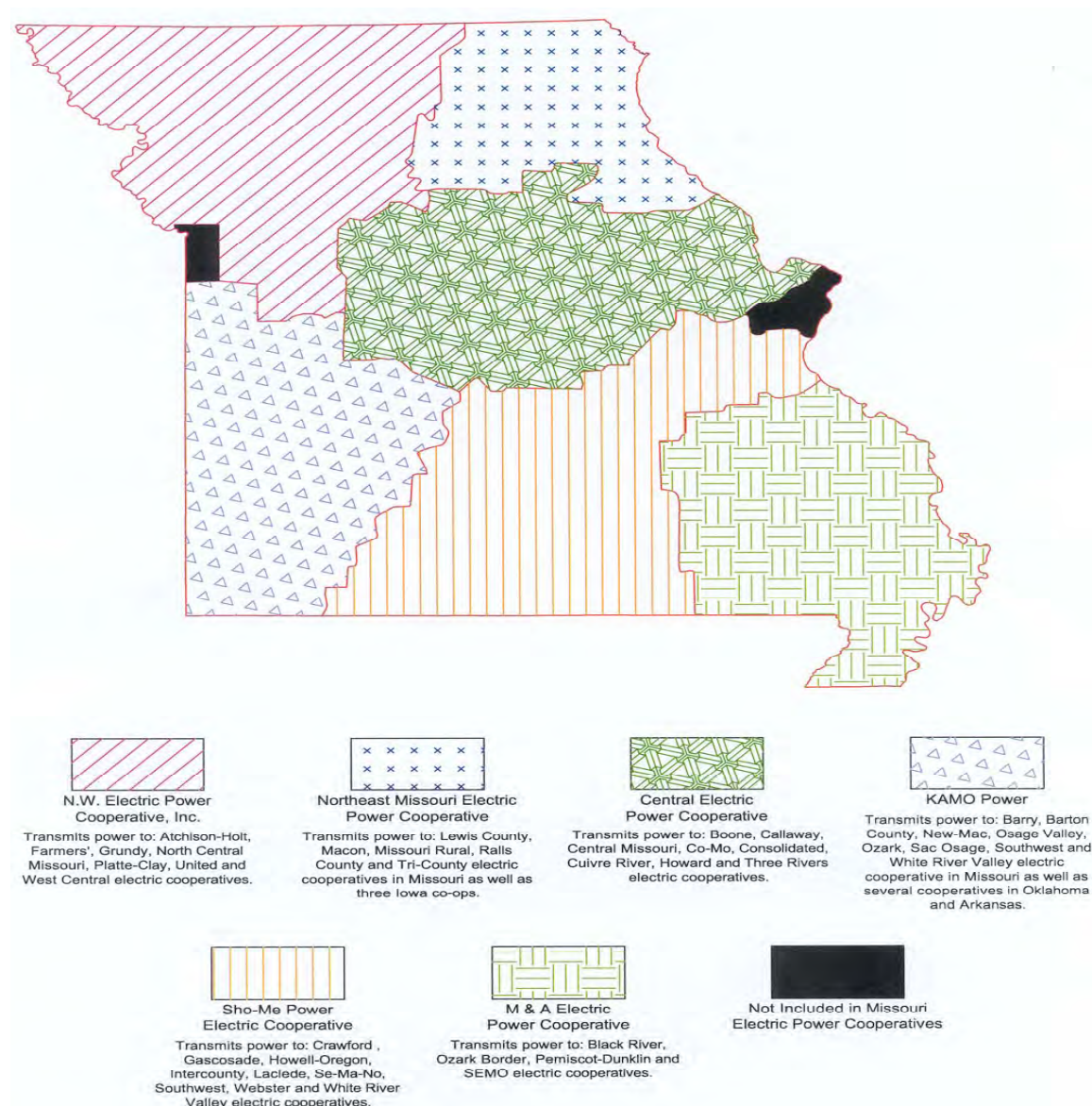
Vulnerability of buried telecommunication cables has always been a problem. Cables may be subject to accidental or intentional cuts. However, legislation and mitigation procedures have been taken to prevent such events. Senate Bill Numbers 214 and 264 provided for the existence of a company called "One Call", which locates and marks buried utilities. Currently, most LECs in the state have their facilities on record with the "One Call" agency. Anyone planning any subsurface digging, drilling, or plowing of any kind is advised and encouraged to use the "One Call" service. Additional steps to prevent cutting of buried telecommunication cables include clearly marking cable routes with above ground pedestals and poles, as well as patrolling the routes by vehicle and air. In addition to these precautions, most companies are presently building fiber rings for the fiber optic routes, to protect continuity of service in the event of an accidental cut.

Since floods pose a threat to telephone service, most companies with buried cables in floodplains are replacing conventional telephone pedestals with flood resistant telephone pedestals, which protect the cables during floods of short duration. For additional information on flooding in Missouri, see Section 3.1.12.

### **Electrical Service**

Electrical utilities in Missouri prepare for disasters and power outages by developing written plans to follow when abnormal events cause extensive outages to customers. Power outages caused by severe weather have prompted the creation of tree trimming plans to ensure above ground power lines are free of potential limbs that could fall on power lines and cause interruptions of power if knocked down. In addition, ongoing review of emergency plans and training for such events has been implemented. During the 2002 ice storm that struck western and northern Missouri, many customers were unable to contact affected utilities by telephone because there were not enough utility representatives to respond to all customer calls. Therefore, an automated system was developed to allow customers to input information to the computer that will automatically generate work orders for service calls. The PSC also advised utility companies to provide feedback to customers that their outage was recorded, to convey assurance that their outage report has been received.

**Figure 70** illustrates the Electrical Cooperatives in Missouri



**Figure 70. Electrical Cooperatives in Missouri**

## Natural Gas

All natural gas system operators in the state operate under the jurisdiction of the PSC. These operators must comply with the Commission's Pipeline Safety Regulations, which include emergency response procedures to pipeline emergencies and natural disasters. Natural gas system operators have plans on file with the PSC. Part of these plans include indexes of utilities and their locations in the state.

In 1989, House Bill 938 provided the Commission with additional legal power to enforce the Pipeline Safety Regulations. In 1990, due in part to the Iben Browning earthquake projection, all utilities were mandated by the Commission to develop natural disaster plans (to include potential impacts of earthquakes) and file the plans with the Commission. The Commission also developed its own plan to respond to a disaster causing an interruption or failure of a utility service. The Iben Browning earthquake projection created a new awareness for the necessity for such disaster response and

recovery plans. Several natural gas companies have since stored emergency equipment and survival rations in protected locations. This also resulted in a new demand for excess flow and motion sensing valves on natural gas service lines. Operators also reviewed, updated or increased their mutual aid agreements with other utilities and contractors.

In 1990, Senate Bill numbers 214 and 264 required all owners and operators of underground pipeline facilities to participate in the Missouri "One Call" notification center. These bills altered the original Chapter 319 Damage Prevention Act and added a penalty clause. This participation provides for the location of underground pipelines after notification by the excavator and before any excavation work begins.

**Figure 71** depicts a map of Missouri pipelines.

**Figure 71. Missouri Pipelines**



### **Synopsis**

Utility companies are generally well prepared to deal with day-to-day outages. The earthquake threat to statewide and multi-states utilities is the greatest concern to the integrity and operability of Missouri's utilities. Planning, regulation, mitigation and mutual aid are all just a few tools available to reduce, speed recovery and prevent utility interruptions and failures.

Earthquake maps showing all pipelines and electrical transmission lines are on file with the State Emergency Management Agency's Earthquake Section.

### 3.3 Assessing Vulnerability By Jurisdiction

**44 CFR 201.4(c)(2)(ii) – The risk assessment shall include an overview and analysis of the State’s vulnerability to the hazards described in this paragraph (c)(2), based on estimates provided in local risk assessments. The State shall describe vulnerability in term of the jurisdictions most threatened by the identified hazards, and most vulnerable to damage and loss associated with hazard events.**

Loss estimates provided herein used available data, and the methodologies applied resulted in an approximation of risk. These estimates should be used to understand relative risk from hazards and potential losses. Uncertainties are inherent in any loss estimation methodology, arising in part from incomplete observed data and scientific knowledge concerning natural hazards and their effects on the built environment. Uncertainties also result from approximations and simplifications that are necessary for a comprehensive analysis (such as incomplete inventories, demographics, or economic parameters). At this stage of Missouri’s hazard mitigation planning effort, there is a data limitation due to the number of local mitigation plans not yet completed. As the information becomes available, the local planning information will be incorporated into the State Hazard Mitigation Plan as appropriate.

To conduct the majority of the risk assessment effort, two distinct hazard risk assessment methodologies were applied, utilizing Hazards United States – Multi-Hazards (HAZUS-MH), FEMA’s loss estimation software, and a statistical risk assessment methodology. Each approach provides estimates for the potential impact by using a common, systematic framework for evaluation. In addition, a third methodology was implemented for a user-defined deterministic earthquake loss estimate for general building stock and social impacts.

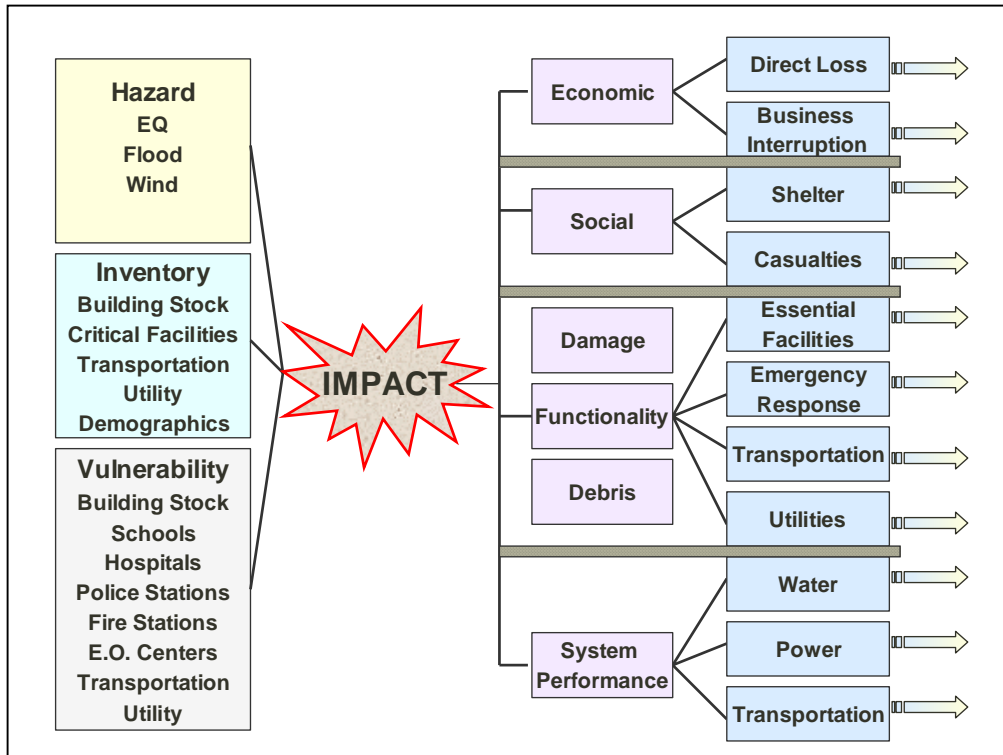
The HAZUS-MH risk assessment methodology is parametric; in that distinct hazard, vulnerability and inventory parameters (earthquake spectral ordinates, hurricane wind speed, first floor elevation, and building types) were modeled using the HAZUS-MH software to determine the impact (damages and losses) on the built environment. The HAZUS-MH software was used to estimate losses from earthquakes, tornados (severe wind) and flood hazards.

The statistical risk assessment methodology was applied to analyze hazards of concern that are outside the scope of the HAZUS-MH software. The methodology uses a statistical approach and mathematical modeling of risk to predict a hazard’s frequency of occurrence and estimated impacts based on recorded or historic damage information. Below is a brief description of both approaches.

#### **HAZUS-MH**

HAZUS-MH is FEMA’s standardized loss estimation software program built upon an integrated Geographic Information System (GIS) platform (**Figure 72a**). This risk assessment applied HAZUS-MH to produce regional profiles and estimate losses for three hazards. At the time this analysis was completed, a new version of HAZUS-MH, scheduled for a Fall 2003 release, was under development to better address potential losses from wind, earthquake, and flood hazards and to incorporate updated baseline data. Accordingly, various modules and beta version of the HAZUS-MH software were used in combination to estimate losses from earthquake, wind, and flood hazards.

**Figure 72a. Conceptual Model of HAZUS-MH Methodology**



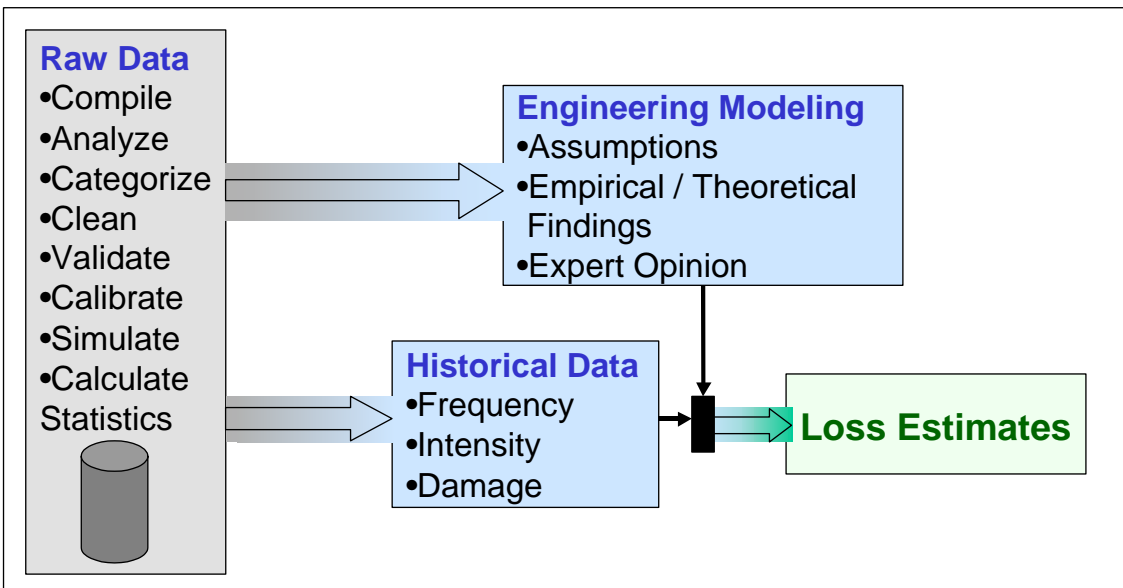
### Statistical Risk Assessment Methodology

Risks associated with other natural hazards were analyzed using a statistical assessment methodology developed and used specifically for this effort. This approach is based on different principals as compared to HAZUS-MH, and does not rely on readily available automated software. Historical data for each hazard are used and statistical evaluations are performed using manual calculations. **Figure 72b** illustrates a conceptual model of the statistical risk assessment methodology as applied to the State of Missouri. The general steps used in the statistical risk assessment methodology are summarized below:

- Compile data from national and local sources
- Conduct statistical analysis of data to relate historical patterns within data to existing hazard models (minimum, maximum, average, and standard deviation)
- Categorize hazard parameters for each hazard to be modeled (e.g., tornado)
- Develop model parameters based on analysis of data, existing hazard models, and risk engineering judgment
- Apply hazard model including:
  - Analysis of frequency of hazard occurrence
  - Analysis of intensity and damage parameters of hazard occurrence
  - Development of intensity and frequency tables and curves based on observed data
  - Development of simple damage function to relate hazard intensity to a level of damage (*for example, one flood = \$ in estimated damages*)
  - Development of exceedence and frequency curves relating a level of damage for each hazard to an annual probability of occurrence
  - Development of annualized loss estimates



**Figure 72b. Conceptual Model of the Statistical Risk Assessment Methodology**



### **Earthquake Methodology For User-Defined 7.6 Scenario**

The objective was to run a user-defined scenario of a magnitude 7.6 earthquake, SEMA's normal catastrophic planning event, to determine jurisdictional loss estimates for the built environment and social vulnerability. The event was epicentered at the location of the historical earthquake events that occurred in 1811 and 1812, in the New Madrid Seismic Zone.

Initially, deterministic jurisdictional loss estimates were analyzed using the HAZUS-MH methodology. To run such an analysis, one must select from several applicable attenuation relationships for the New Madrid region. The Frankle attenuation relationship was selected (note: this choice is a subjective decision; other attenuation functions, such as Toro, might result in different assessments).

Next, per SEMA's determination, another deterministic loss assessment was conducted based on the ground motion indicated by the Modified Mercalli Intensity (MMI) map provided (by the client). For this task, several subjective choices were made:

- Choose among different MMI to PGA relationships
- Translate the built-in HAZUS building and contents damage functions from spectral ordinates to peak ground acceleration
- Translate the resulting damage functions into those against peak ground acceleration
- Translate the above damage functions, yet again to against MMI
- Aggregate the general building stock inventory at county level assuming the ground motion to be uniform across a county

## Population

Missouri has a surface land area of 68,886 square miles and a population of 5,595,211 (2000 census).

Missouri ranks 17th among the 50 states in population; 18th in land area, and 27th in population density. Within the state are 960 incorporated cities, towns, and villages.

In 1830, the first year of statehood, Missouri had a population of 140,455. The 1970 census showed 4,677,623 inhabitants, and the 1980 census showed 4,917,444 residents; in 1990, the census indicated another population increase to 5,117,073; in 2000, the census showed 5,595,211 inhabitants.

The population center of the United States continues to inch westward and is currently located ¼ mile west of the City of DeSoto, Missouri.

Missouri Population.....	5,595,211
Area Square Miles .....	68,886
Population Equivalent per Square Mile.....	67.79
Number of Incorporated Cities, Towns, and Villages .....	960
Number of Counties.....	114
Urban Population .....	70%
Metropolitan Population .....	64% of Total Urban Population
Cities with a Population of 50,000 or More .....	5
Counties with a Population Greater than 500,000 .....	2
(St. Louis and Jackson)	
Counties with a Population of 200,000 to 500,000 .....	2
(Greene and St. Charles)	
Counties with a Population of 100,000 to 200,000 .....	4
(Boone, Clay, Jasper, and Jefferson)	
Counties with a Population of 50,000 to 100,000 .....	9
Counties with a Population of 25,000 to 50,000 .....	22
Counties with a Population of 15,000 to 25,000 .....	28
Counties with a Population of 10,000 to 15,000 .....	21
Counties with a Population of 1 to 10,000 .....	26

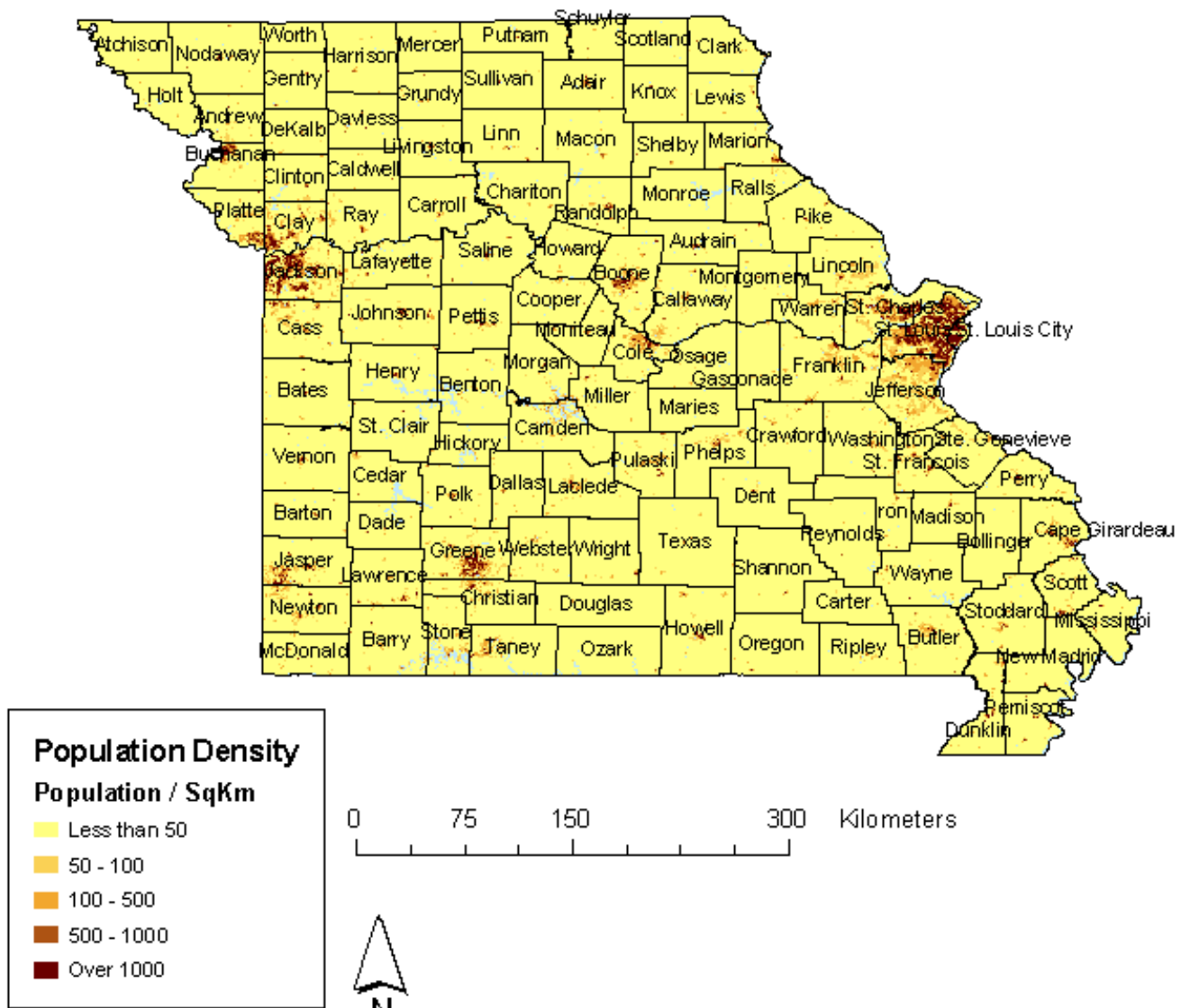
Ten of the 114 counties (8.77 percent) represent over 74 percent of the total population; two of these ten (St. Louis and Jackson Counties) contain 34 percent of the state's total population.

Approximately 2,000,000 people are employed in Missouri. Each year, more than 30,000 new high school graduates enter the state's labor market.



**Figure 73** shows the extent of the study area, as well as the population density distribution at the county level (based on Census 2000) for 114 counties in the State of Missouri. **Tables 31** and **32** provide a numeric breakdown by county of the population and estimated dollar exposure that was the basis of the risk assessment presented in this report, respectively. This information was derived from HAZUS-MH (October 2003). However, state provided data was used for the State Facility vulnerability assessment and loss estimates.

**Figure 73. Population Density Distribution Map for Missouri**



**Table 31. Population and Building Count Distribution**

County FIPS	County	Population (2000)	Building Count (HAZUS-MH)									
			Residential	Commercial	Medical & Hospital	Industrial	Agriculture	Education	Government	Emergency	Religion	Total
29001	Adair	24,977	7,167	86	34	4	5	9	3	1	9	7,318
29003	Andrew	16,492	5,510	33	2	1	2	0	1	0	2	5,551
29005	Atchison	6,430	2,075	19	1	0	5	0	1	0	2	2,103
29007	Audrain	25,853	8,318	52	15	18	9	0	7	1	2	8,422
29009	Barry	34,010	12,069	110	6	32	6	0	2	1	13	12,239
29011	Barton	12,541	4,129	29	2	3	2	0	1	0	1	4,167
29013	Bates	16,653	5,547	39	3	2	8	0	1	0	2	5,602
29015	Benton	17,180	9,042	42	1	6	5	0	3	0	10	9,109
29017	Bollinger	12,029	4,385	16	1	0	1	0	1	0	5	4,409
29019	Boone	135,454	38,079	484	115	47	8	8	23	1	37	38,802
29021	Buchanan	85,998	25,839	275	84	47	0	0	7	0	19	26,271
29023	Butler	40,867	13,543	167	38	23	10	2	6	2	14	13,805
29025	Caldwell	8,969	3,009	6	0	0	0	0	0	0	0	3,015
29027	Callaway	40,766	13,264	58	1	4	1	1	3	1	3	13,336
29029	Camden	37,051	22,407	190	28	27	0	0	5	2	12	22,671
29031	CapeGirardeau	68,693	21,081	257	53	27	1	2	7	2	16	21,446
29033	Carroll	10,285	3,597	23	0	10	7	0	22	0	2	3,661
29035	Carter	5,941	2,342	14	3	4	0	0	3	0	3	2,369
29037	Cass	82,092	26,004	134	17	17	3	1	1	2	10	26,189
29039	Cedar	13,733	5,025	41	4	1	3	0	0	0	4	5,078
29041	Chariton	8,438	3,247	20	0	2	8	0	0	0	3	3,280
29043	Christian	54,285	17,235	74	4	24	0	0	1	0	5	17,343
29045	Clark	7,416	2,741	10	2	1	5	0	1	0	1	2,761
29047	Clay	184,006	55,758	539	105	78	1	1	9	2	42	56,535
29049	Clinton	18,979	6,239	24	7	4	1	0	5	0	2	6,282
29051	Cole	71,397	20,749	226	46	23	0	0	160	6	26	21,236
29053	Cooper	16,670	5,057	55	4	2	1	0	2	0	3	5,124
29055	Crawford	22,804	8,428	52	2	2	0	0	1	0	5	8,490
29057	Dade	7,923	2,899	8	0	1	2	0	2	0	1	2,913
29059	Dallas	15,661	5,371	44	2	2	2	0	2	1	2	5,426

County FIPS	County	Population (2000)	Building Count (HAZUS-MH)									
			Residential	Commercial	Medical & Hospital	Industrial	Agriculture	Education	Government	Emergency	Religion	Total
29061	Daviess	8,016	2,878	12	1	13	1	0	1	0	1	2,907
29063	DeKalb	11,597	2,780	25	3	0	2	0	5	0	0	2,815
29065	Dent	14,927	5,314	43	3	8	2	0	2	0	8	5,380
29067	Douglas	13,084	4,576	23	2	0	1	0	0	0	1	4,603
29069	Dunklin	33,155	10,438	65	10	9	1	0	2	0	5	10,530
29071	Franklin	93,807	31,167	209	29	65	0	4	4	0	21	31,499
29073	Gasconade	15,342	6,015	33	0	12	1	0	1	0	5	6,067
29075	Gentry	6,861	2,239	18	2	1	4	0	4	0	0	2,268
29077	Greene	240,391	71,961	1,022	236	100	1	10	30	0	73	73,433
29079	Grundy	10,432	3,516	22	4	1	3	0	2	0	5	3,553
29081	Harrison	8,850	3,085	22	0	0	1	0	0	0	1	3,109
29083	Henry	21,997	7,557	54	9	8	0	0	1	4	4	7,637
29085	Hickory	8,940	4,883	16	3	0	0	0	2	0	3	4,907
29087	Holt	5,351	2,109	18	0	0	6	0	1	0	2	2,136
29089	Howard	10,212	3,411	14	0	0	0	0	0	0	1	3,426
29091	Howell	37,238	12,021	100	15	11	0	0	3	2	6	12,158
29093	Iron	10,697	3,782	19	2	5	0	0	1	0	7	3,816
29095	Jackson	654,880	189,194	2,641	462	376	10	5	80	26	176	192,970
29097	Jasper	104,686	32,603	357	57	85	3	3	8	1	20	33,137
29099	Jefferson	198,099	63,790	364	52	57	0	9	8	1	30	64,311
29101	Johnson	48,258	13,810	90	19	18	2	65	18	1	14	14,037
29103	Knox	4,361	1,646	9	0	1	6	0	0	0	3	1,665
29105	Laclede	32,513	10,864	87	12	39	0	0	3	0	11	11,016
29107	Lafayette	32,960	10,613	91	7	6	12	0	1	0	7	10,737
29109	Lawrence	35,204	11,096	62	8	17	10	0	2	0	16	11,211
29111	Lewis	10,494	3,372	14	1	0	6	0	2	0	3	3,398
29113	Lincoln	38,944	13,447	43	14	5	1	0	0	0	2	13,512
29115	Linn	13,754	4,726	24	2	7	5	0	5	0	3	4,772
29117	Livingston	14,558	4,603	53	0	4	3	0	1	0	2	4,666
29119	McDonald	21,681	7,092	33	3	12	6	0	2	0	4	7,152
29121	Macon	15,762	5,584	22	2	2	1	0	4	0	3	5,618
29123	Madison	11,800	4,218	27	3	10	1	0	1	0	5	4,265

County FIPS	County	Population (2000)	Building Count (HAZUS-MH)									
			Residential	Commercial	Medical & Hospital	Industrial	Agriculture	Education	Government	Emergency	Religion	Total
29125	Maries	8,903	3,288	14	1	2	2	0	1	0	3	3,311
29127	Marion	28,289	8,700	85	18	16	2	1	12	0	8	8,842
29129	Mercer	3,757	1,559	8	0	0	2	0	1	0	1	1,571
29131	Miller	23,564	8,397	51	5	9	1	0	2	0	5	8,470
29133	Mississippi	13,427	4,177	18	3	3	3	0	1	0	4	4,209
29135	Moniteau	14,827	4,440	18	1	7	2	0	6	0	5	4,479
29137	Monroe	9,311	3,581	18	1	2	5	0	0	0	0	3,607
29139	Montgomery	12,136	4,676	30	2	7	6	0	1	0	2	4,724
29141	Morgan	19,309	10,941	53	4	5	2	0	1	1	4	11,011
29143	NewMadrid	19,760	6,214	45	3	5	3	0	2	0	4	6,276
29145	Newton	52,636	17,471	107	24	24	2	3	4	0	8	17,643
29147	Nodaway	21,912	6,038	59	12	16	13	0	5	0	7	6,150
29149	Oregon	10,344	3,681	26	0	3	2	0	1	0	6	3,719
29151	Osage	13,062	4,717	20	1	31	6	4	2	0	0	4,781
29153	Ozark	9,542	4,119	18	1	2	1	0	1	0	3	4,145
29155	Pemiscot	20,047	5,987	34	7	3	31	0	4	1	7	6,074
29157	Perry	18,132	6,176	69	6	18	5	0	1	1	14	6,290
29159	Pettis	39,403	12,161	135	12	33	3	1	3	0	0	12,348
29161	Phelps	39,825	12,387	99	13	5	0	1	11	1	11	12,528
29163	Pike	18,351	5,672	65	1	2	4	0	6	0	4	5,754
29165	Platte	73,781	21,593	160	19	13	1	1	4	0	8	21,799
29167	Polk	26,992	8,557	60	3	4	6	2	1	0	5	8,638
29169	Pulaski	41,165	11,358	108	6	6	2	0	19	0	14	11,513
29171	Putnam	5,223	2,048	9	0	1	2	0	1	0	1	2,062
29173	Ralls	9,626	3,707	14	0	1	3	0	1	0	3	3,729
29175	Randolph	24,663	8,057	73	15	28	4	1	6	1	5	8,190
29177	Ray	23,354	7,603	17	3	8	1	0	1	0	1	7,634
29179	Reynolds	6,689	2,930	11	1	6	0	0	2	0	3	2,953
29181	Ripley	13,509	4,906	27	3	13	1	0	0	0	3	4,953
29183	St.Charles	283,883	84,577	659	125	97	0	17	36	2	45	85,558
29185	St.Clair	9,652	3,983	22	3	0	2	0	1	0	2	4,013
29186	St.Genevieve	17,842	6,369	38	9	18	0	0	2	0	3	6,439

County FIPS	County	Population (2000)	Building Count (HAZUS-MH)									
			Residential	Commercial	Medical & Hospital	Industrial	Agriculture	Education	Government	Emergency	Religion	Total
29187	St.Francois	55,641	17,166	117	34	14	0	0	9	1	4	17,345
29189	St.Louis	1,016,315	307,131	4,020	823	793	14	18	64	14	305	313,182
29195	Saline	23,756	7,452	65	9	12	11	0	6	0	6	7,561
29197	Schuyler	4,170	1,421	8	2	0	7	0	1	0	0	1,439
29199	Scotland	4,983	1,685	15	0	2	6	0	1	0	0	1,709
29201	Scott	40,422	12,762	99	17	16	5	0	5	2	9	12,915
29203	Shannon	8,324	2,723	9	1	2	1	0	0	0	2	2,738
29205	Shelby	6,799	2,384	12	0	5	4	0	1	0	3	2,409
29207	Stoddard	29,705	9,814	79	6	5	0	0	0	0	2	9,906
29209	Stone	28,658	12,551	74	13	15	0	0	2	1	15	12,671
29211	Sullivan	7,219	2,490	21	3	1	4	0	1	0	1	2,521
29213	Taney	39,703	13,491	271	19	6	1	0	6	1	16	13,811
29215	Texas	23,003	7,916	51	8	14	0	0	8	0	10	8,007
29217	Vernon	20,454	6,602	55	3	19	8	0	1	0	4	6,692
29219	Warren	24,525	9,339	42	3	7	1	0	3	0	8	9,403
29221	Washington	23,344	7,762	23	3	5	0	0	6	0	12	7,811
29223	Wayne	13,259	5,941	23	4	6	0	0	0	0	8	5,982
29225	Webster	31,045	9,528	57	3	18	56	0	1	0	8	9,671
29227	Worth	2,382	881	4	0	0	2	0	0	0	0	887
29229	Wright	17,955	5,931	39	4	0	1	0	0	0	5	5,980
29510	St.LouisCity	348,189	84,736	1,429	194	260	0	20	59	26	103	86,827

**Table 32. Estimated Values for the Key Occupancies (Uses) for the State of Missouri (2002 Valuations)**

County FIPS	County	Population (2000)	Value (\$1,000) (HAZUS-MH)									
			Residential	Commercial	Medical & Hospital	Industrial	Agriculture	Education	Government	Emergency	Religious	Total
29001	Adair	24,977	1,732,154	296,304	112,411	38,443	25,016	132,142	6,606	2,110	45,818	<b>2,391,004</b>
29003	Andrew	16,492	1,114,090	135,382	6,621	18,476	12,466	8,220	1,608	1,157	15,454	<b>1,313,474</b>
29005	Atchison	6,430	501,019	93,432	11,459	12,491	24,992	9,520	1,536	0	11,912	<b>666,361</b>
29007	Audrain	25,853	1,769,427	275,874	99,733	154,256	37,520	15,501	16,018	2,415	24,706	<b>2,395,450</b>
29009	Barry	34,010	2,198,895	429,452	29,201	234,994	32,074	17,411	5,076	2,042	65,562	<b>3,014,707</b>
29011	Barton	12,541	797,417	145,562	8,560	27,891	10,124	8,760	2,420	1,837	5,158	<b>1,007,729</b>
29013	Bates	16,653	1,056,922	154,960	9,746	52,340	36,202	1,412	2,058	0	12,162	<b>1,325,802</b>
29015	Benton	17,180	1,525,313	171,420	9,793	42,059	18,760	6,995	4,842	0	43,202	<b>1,822,384</b>
29017	Bollinger	12,029	758,993	93,782	2,759	19,099	12,996	13,662	2,618	1,259	22,882	<b>928,050</b>
29019	Boone	135,454	9,593,383	2,104,896	372,245	342,288	52,918	215,235	49,336	3,198	179,882	<b>12,913,381</b>
29021	Buchanan	85,998	6,068,489	1,178,610	514,182	417,807	17,684	32,626	16,234	1,191	110,384	<b>8,357,207</b>
29023	Butler	40,867	2,688,077	637,110	159,563	142,435	46,626	52,433	12,004	6,499	58,784	<b>3,803,531</b>
29025	Caldwell	8,969	569,068	43,516	3,311	4,874	11,932	9,650	904	0	8,648	<b>651,903</b>
29027	Callaway	40,766	2,526,661	298,780	15,844	54,543	14,424	42,113	9,282	3,912	29,358	<b>2,994,917</b>
29029	Camden	37,051	5,117,499	711,808	101,954	172,647	7,850	26,487	10,258	6,873	57,676	<b>6,213,052</b>
29031	Cape Girardeau	68,693	4,930,329	1,061,644	145,894	197,281	17,316	59,156	15,334	7,553	82,686	<b>6,517,193</b>
29033	Carroll	10,285	728,005	117,730	1,383	53,440	32,904	12,418	44,068	0	8,534	<b>998,482</b>
29035	Carter	5,941	392,299	43,540	4,867	28,046	3,634	16,536	5,510	0	14,830	<b>509,262</b>
29037	Cass	82,092	5,682,181	556,414	52,428	139,447	27,200	21,000	2,478	6,364	43,706	<b>6,531,218</b>
29039	Cedar	13,733	934,017	159,078	21,425	30,915	15,996	3,432	252	1,089	26,282	<b>1,192,486</b>
29041	Chariton	8,438	662,222	110,890	2,566	28,211	29,970	5,272	1,500	0	14,946	<b>855,577</b>
29043	Christian	54,285	3,527,431	416,930	11,412	178,094	8,836	4,957	3,268	0	32,606	<b>4,183,534</b>
29045	Clark	7,416	496,391	56,286	12,321	9,881	19,474	7,258	1,824	0	5,318	<b>608,753</b>
29047	Clay	184,006	14,094,399	2,635,840	387,760	622,286	26,752	62,308	22,206	11,297	229,606	<b>18,092,454</b>
29049	Clinton	18,979	1,361,303	125,308	33,179	34,948	16,530	6,368	10,140	0	14,994	<b>1,602,770</b>
29051	Cole	71,397	5,041,114	969,892	215,940	188,435	12,538	48,310	318,078	21,367	137,648	<b>6,953,322</b>
29053	Cooper	16,670	1,080,025	245,218	12,794	27,707	10,374	11,244	4,472	783	22,172	<b>1,414,789</b>
29055	Crawford	22,804	1,575,873	225,564	7,925	52,554	9,300	26,614	4,004	1,803	31,480	<b>1,935,117</b>
29057	Dade	7,923	531,806	55,920	2,110	27,009	12,828	11,080	3,414	0	11,408	<b>655,575</b>

County FIPS	County	Population (2000)	Value (\$1,000) (HAZUS-MH)									
			Residential	Commercial	Medical & Hospital	Industrial	Agriculture	Education	Government	Emergency	Religious	Total
29059	Dallas	15,661	908,853	152,092	8,025	27,420	12,092	18,966	3,794	3,301	17,722	1,152,265
29061	Daviess	8,016	562,571	65,734	4,075	76,447	11,176	4,826	1,318	578	8,990	735,715
29063	DeKalb	11,597	601,282	108,682	6,427	6,377	11,096	0	10,618	0	8,492	752,974
29065	Dent	14,927	960,133	176,434	31,994	58,707	11,088	12,824	4,784	0	37,042	1,293,006
29067	Douglas	13,084	804,811	90,994	3,310	4,105	3,202	3,044	1,956	0	6,798	918,220
29069	Dunklin	33,155	2,036,796	328,222	30,562	69,437	22,406	13,376	7,136	408	37,832	2,546,175
29071	Franklin	93,807	6,253,275	973,532	79,032	448,953	16,188	94,057	9,134	1,770	111,546	7,987,487
29073	Gasconade	15,342	1,151,281	177,542	3,765	78,473	12,770	13,232	1,480	953	24,802	1,464,298
29075	Gentry	6,861	491,779	98,644	6,591	14,173	16,414	7,294	8,650	0	7,914	651,459
29077	Greene	240,391	17,838,684	4,113,794	1,085,298	782,120	47,024	241,969	65,596	2,279	352,622	24,529,386
29079	Grundy	10,432	769,882	111,446	29,044	10,450	13,236	14,756	4,154	0	18,346	971,314
29081	Harrison	8,850	657,790	105,326	1,949	7,738	13,356	10,876	500	0	11,420	808,955
29083	Henry	21,997	1,529,765	288,742	42,228	92,856	11,838	20,732	5,058	13,473	27,994	2,032,686
29085	Hickory	8,940	677,520	64,402	4,088	11,293	6,554	5,698	3,340	1,327	12,000	786,222
29087	Holt	5,351	423,228	65,568	2,369	8,555	21,556	0	2,872	0	9,238	533,386
29089	Howard	10,212	674,108	61,018	3,410	15,160	7,744	8,843	1,482	0	10,656	782,421
29091	Howell	37,238	2,187,013	485,936	52,608	91,889	13,062	19,723	10,062	8,778	47,436	2,916,507
29093	Iron	10,697	698,960	76,324	9,225	27,713	2,978	260	1,480	0	25,908	842,848
29095	Jackson	654,880	49,492,907	11,305,220	2,083,049	2,699,381	93,742	359,170	162,884	95,476	862,292	67,154,121
29097	Jasper	104,686	7,064,038	1,624,732	185,998	550,626	31,206	91,125	17,056	5,885	104,892	9,675,558
29099	Jefferson	198,099	12,489,199	1,519,222	287,914	520,038	24,568	217,455	18,844	3,743	159,166	15,240,149
29101	Johnson	48,258	3,032,937	389,224	72,985	120,328	19,180	953,223	40,908	2,450	66,438	4,697,673
29103	Knox	4,361	349,481	42,900	682	9,613	24,656	7,255	812	0	9,080	444,479
29105	Laclede	32,513	1,951,567	419,770	47,974	294,784	11,772	19,834	6,010	0	54,338	2,806,049
29107	Lafayette	32,960	2,226,787	435,660	20,584	62,884	50,126	23,348	5,024	0	39,238	2,863,651
29109	Lawrence	35,204	2,163,050	300,196	45,346	125,983	45,034	17,336	5,432	0	66,906	2,769,283
29111	Lewis	10,494	678,911	69,710	3,671	9,290	20,614	706	3,182	0	12,710	798,794
29113	Lincoln	38,944	2,357,526	250,202	66,676	49,124	12,282	5,214	652	0	26,720	2,768,396
29115	Linn	13,754	963,488	156,742	7,076	49,375	26,676	13,448	6,430	748	24,878	1,248,861
29117	Livingston	14,558	1,005,802	214,384	4,002	33,794	15,692	11,730	5,470	0	12,294	1,303,168
29119	McDonald	21,681	1,180,846	134,016	9,330	87,256	27,548	18,934	5,010	0	27,336	1,490,276
29121	Macon	15,762	1,105,077	135,572	29,154	29,476	7,584	5,623	11,028	0	17,724	1,341,238



County FIPS	County	Population (2000)	Value (\$1,000) (HAZUS-MH)									
			Residential	Commercial	Medical & Hospital	Industrial	Agriculture	Education	Government	Emergency	Religious	Total
29123	Madison	11,800	766,683	122,074	20,080	69,125	9,104	7,702	2,422	1,565	23,956	1,022,711
29125	Maries	8,903	576,736	65,006	1,882	32,445	13,974	7,164	2,058	0	8,600	707,865
29127	Marion	28,289	2,054,399	347,928	96,218	120,203	20,062	21,785	25,258	0	40,978	2,726,831
29129	Mercer	3,757	292,991	35,896	2,565	6,181	8,474	2,636	2,230	0	5,110	356,083
29131	Miller	23,564	1,588,332	235,818	9,881	72,495	13,278	12,938	3,088	0	24,574	1,960,404
29133	Mississippi	13,427	851,006	98,624	5,159	20,457	14,108	4,752	2,004	0	17,114	1,013,224
29135	Moniteau	14,827	916,358	94,620	11,737	64,661	14,406	6,866	12,010	817	23,570	1,145,045
29137	Monroe	9,311	629,480	65,718	3,375	17,863	21,080	7,608	380	0	7,552	753,056
29139	Montgomery	12,136	902,361	156,380	7,368	46,065	26,748	8,686	4,128	0	11,934	1,163,670
29141	Morgan	19,309	1,920,009	311,138	18,804	58,226	14,754	6,310	2,768	3,097	31,076	2,366,182
29143	NewMadrid	19,760	1,204,815	254,036	11,493	37,949	21,208	31,740	3,614	0	25,580	1,590,435
29145	Newton	52,636	3,317,803	523,536	139,494	165,335	19,788	82,723	7,568	2,484	53,466	4,312,197
29147	Nodaway	21,912	1,534,194	231,150	69,871	121,694	45,914	27,937	9,466	748	35,246	2,076,220
29149	Oregon	10,344	618,484	107,744	3,377	19,822	10,294	5,268	2,370	953	19,328	787,640
29151	Osage	13,062	942,493	116,686	16,541	203,276	23,634	70,887	3,882	0	8,830	1,386,229
29153	Ozark	9,542	680,553	98,762	3,018	42,608	8,088	4,214	1,280	0	9,524	848,047
29155	Pemiscot	20,047	1,182,067	174,118	25,959	31,581	125,206	17,188	9,374	3,948	30,476	1,599,917
29157	Perry	18,132	1,232,368	242,830	49,771	197,186	26,374	7,017	4,804	2,313	65,306	1,827,969
29159	Pettis	39,403	2,604,101	663,380	30,073	249,075	22,728	35,988	8,874	748	22,716	3,637,683
29161	Phelps	39,825	2,647,518	457,370	34,212	82,193	8,858	46,571	23,136	4,628	62,468	3,366,954
29163	Pike	18,351	1,149,212	224,192	8,746	41,624	27,808	20,270	13,130	953	23,934	1,509,869
29165	Platte	73,781	5,772,445	732,882	62,959	163,361	13,658	37,490	8,756	1,565	47,392	6,840,508
29167	Polk	26,992	1,634,455	289,800	21,384	76,366	35,722	35,870	1,518	0	36,902	2,132,017
29169	Pulaski	41,165	2,864,818	392,872	50,867	54,136	8,934	32,257	35,472	0	69,430	3,508,786
29171	Putnam	5,223	378,668	40,308	5,143	10,766	10,124	928	1,498	0	7,026	454,461
29173	Ralls	9,626	673,922	73,082	695	12,630	14,544	4,714	2,944	0	9,676	792,207
29175	Randolph	24,663	1,605,123	312,918	72,567	165,548	18,346	26,170	14,314	2,212	30,416	2,247,614
29177	Ray	23,354	1,573,853	123,456	22,689	99,656	8,706	8,103	3,474	2,892	24,852	1,867,681
29179	Reynolds	6,689	532,035	43,486	3,116	34,539	2,954	5,402	4,234	0	13,892	639,658
29181	Ripley	13,509	780,348	117,782	11,637	95,342	6,366	8,610	1,444	0	14,396	1,035,925
29183	St.Charles	283,883	20,427,039	2,956,242	368,442	747,904	46,110	340,128	74,120	6,227	223,278	25,189,490
29185	St.Clair	9,652	646,006	88,320	17,804	10,000	12,286	2,636	4,062	0	12,112	793,226



County FIPS	County	Population (2000)	Value (\$1,000) (HAZUS-MH)									
			Residential	Commercial	Medical & Hospital	Industrial	Agriculture	Education	Government	Emergency	Religious	Total
29186	St.Genevieve	17,842	1,217,471	161,710	63,745	125,299	9,712	4,548	6,026	0	18,390	<b>1,606,901</b>
29187	St.Francois	55,641	3,547,045	540,718	200,320	112,890	13,546	21,142	19,106	3,743	47,848	<b>4,506,358</b>
29189	St.Louis	1,016,315	81,795,365	19,281,462	2,757,842	5,470,474	175,468	775,051	135,170	67,063	1,383,338	<b>111,841,233</b>
29195	Saline	23,756	1,690,097	288,514	42,154	104,283	42,492	24,404	14,296	0	33,410	<b>2,239,650</b>
29197	Schuyler	4,170	289,318	39,100	4,739	6,037	24,514	6,366	3,070	0	4,244	<b>377,388</b>
29199	Scotland	4,983	335,316	69,490	1,601	23,591	20,724	3,456	3,594	0	5,292	<b>463,064</b>
29201	Scott	40,422	2,548,210	500,566	90,083	147,603	37,740	21,528	11,436	4,458	51,036	<b>3,412,660</b>
29203	Shannon	8,324	481,101	44,902	7,490	12,324	5,652	556	578	0	8,830	<b>561,433</b>
29205	Shelby	6,799	490,832	64,662	520	43,357	18,846	9,634	2,238	0	14,418	<b>644,507</b>
29207	Stoddard	29,705	1,941,769	286,246	44,856	54,509	8,550	2,190	3,522	817	29,108	<b>2,371,567</b>
29209	Stone	28,658	2,287,996	293,380	34,226	84,130	9,476	21,992	4,170	1,973	57,806	<b>2,795,149</b>
29211	Sullivan	7,219	483,976	76,942	7,023	8,218	16,956	5,570	2,834	0	10,172	<b>611,691</b>
29213	Taney	39,703	2,950,244	977,546	96,633	94,514	11,520	23,016	14,808	6,636	75,458	<b>4,250,375</b>
29215	Texas	23,003	1,430,715	251,296	34,184	103,314	18,512	19,842	15,390	0	52,860	<b>1,926,113</b>
29217	Vernon	20,454	1,388,431	234,950	9,122	110,657	27,284	8,224	2,798	1,565	23,068	<b>1,806,099</b>
29219	Warren	24,525	1,743,656	201,448	11,627	85,167	9,486	18,114	5,434	0	41,342	<b>2,116,274</b>
29221	Washington	23,344	1,184,639	121,042	9,667	34,321	6,764	3,638	10,982	0	51,624	<b>1,422,677</b>
29223	Wayne	13,259	902,478	101,358	17,674	55,210	6,034	9,652	362	1,702	34,540	<b>1,129,010</b>
29225	Webster	31,045	1,806,454	268,040	17,977	122,892	215,214	15,706	3,956	0	39,104	<b>2,489,343</b>
29227	Worth	2,382	188,605	22,020	1,688	6,739	7,224	889	1,300	0	3,058	<b>231,523</b>
29229	Wright	17,955	1,058,852	198,810	12,840	24,088	16,134	30,493	2,438	0	36,174	<b>1,379,829</b>
29510	St.LouisCity	348,189	25,762,469	5,913,442	818,826	2,013,566	13,350	484,946	119,002	94,413	485,856	<b>35,705,870</b>

### 3.3.1 Earthquake

HAZUS-MH ground shaking data, inventory and damage functions, and methodology were used to determine the annual expected loss at the county level (**Table 33**). **Table 34** shows annual expected loss at the county level in the event of a 7.6 magnitude earthquake event. **Table 35** shows social vulnerability estimates by county in the event of a 7.6 magnitude earthquake, while **Table 36** shows definitions of severity, displacement, and shelter as used in Table 35.

**Table 33. Estimates of Expected Annualized Losses due to Earthquakes by County**

County	Exposure at Risk From Earthquake (\$1,000)	Estimated Annualized Earthquake Loss (\$1,000)	Percent Loss Ratio (%)
Adair	2,391,004	26,857	0.001%
Andrew	1,313,474	10,652	0.001%
Atchison	666,361	8,276	0.001%
Audrain	2,395,450	90,195	0.004%
Barry	3,014,707	100,552	0.003%
Barton	1,007,729	21,479	0.002%
Bates	1,325,802	22,688	0.002%
Benton	1,822,384	49,031	0.003%
Bollinger	928,050	173,122	0.019%
Boone	12,913,381	419,820	0.003%
Buchanan	8,357,207	92,324	0.001%
Butler	3,803,531	706,525	0.019%
Caldwell	651,903	17,088	0.003%
Callaway	2,994,917	138,369	0.005%
Camden	6,213,052	242,949	0.004%
CapeGirardeau	6,517,193	1,624,582	0.025%
Carroll	998,482	26,907	0.003%
Carter	509,262	93,227	0.018%
Cass	6,531,218	87,555	0.001%
Cedar	1,192,486	41,904	0.004%
Chariton	855,577	32,376	0.004%
Christian	4,183,534	186,181	0.004%
Clark	608,753	30,972	0.005%
Clay	18,092,454	213,387	0.001%
Clinton	1,602,770	38,477	0.002%
Cole	6,953,322	319,410	0.005%
Cooper	1,414,789	60,337	0.004%
Crawford	1,935,117	249,765	0.013%
Dade	655,575	43,218	0.007%
Dallas	1,152,265	68,761	0.006%
Daviess	735,715	34,855	0.005%
DeKalb	752,974	36,756	0.005%
Dent	1,293,006	191,157	0.015%
Douglas	918,220	98,765	0.011%
Dunklin	2,546,175	799,944	0.031%
Franklin	7,987,487	956,328	0.012%
Gasconade	1,464,298	150,642	0.010%

County	Exposure at Risk From Earthquake (\$1,000)	Estimated Annualized Earthquake Loss (\$1,000)	Percent Loss Ratio (%)
Gentry	651,459	41,208	0.006%
Greene	24,529,386	1,002,444	0.004%
Grundy	971,314	45,521	0.005%
Harrison	808,955	44,431	0.005%
Henry	2,032,686	74,194	0.004%
Hickory	786,222	62,899	0.008%
Holt	533,386	48,217	0.009%
Howard	782,421	60,623	0.008%
Howell	2,916,507	397,018	0.014%
Iron	842,848	172,883	0.021%
Jackson	67,154,121	801,760	0.001%
Jasper	9,675,558	223,819	0.002%
Jefferson	15,240,149	2,160,898	0.014%
Johnson	4,697,673	115,666	0.002%
Knox	444,479	56,699	0.013%
Laclede	2,806,049	183,769	0.007%
Lafayette	2,863,651	88,217	0.003%
Lawrence	2,769,283	131,146	0.005%
Lewis	798,794	70,286	0.009%
Lincoln	2,768,396	264,953	0.010%
Linn	1,248,861	69,970	0.006%
Livingston	1,303,168	70,190	0.005%
Macon	1,341,238	79,289	0.006%
Madison	1,022,711	203,076	0.020%
Maries	707,865	110,157	0.016%
Marion	2,726,831	146,376	0.005%
McDonald	1,490,276	94,078	0.006%
Mercer	356,083	65,933	0.019%
Miller	1,960,404	142,380	0.007%
Mississippi	1,013,224	524,778	0.052%
Moniteau	1,145,045	100,034	0.009%
Monroe	753,056	87,177	0.012%
Montgomery	1,163,670	135,488	0.012%
Morgan	2,366,182	139,534	0.006%
NewMadrid	1,590,435	760,857	0.048%
Newton	4,312,197	160,775	0.004%
Nodaway	2,076,220	88,085	0.004%
Oregon	787,640	191,659	0.024%
Osage	1,386,229	152,987	0.011%
Ozark	848,047	152,322	0.018%
Pemiscot	1,599,917	773,002	0.048%
Perry	1,827,969	370,630	0.020%
Pettis	3,637,683	151,883	0.004%
Phelps	3,366,954	391,020	0.012%
Pike	1,509,869	156,252	0.010%
Platte	6,840,508	151,849	0.002%

County	Exposure at Risk From Earthquake (\$1,000)	Estimated Annualized Earthquake Loss (\$1,000)	Percent Loss Ratio (%)
Polk	2,132,017	145,330	0.007%
Pulaski	3,508,786	342,860	0.010%
Putnam	454,461	87,894	0.019%
Ralls	792,207	110,852	0.014%
Randolph	2,247,614	135,729	0.006%
Ray	1,867,681	106,285	0.006%
Reynolds	639,658	185,671	0.029%
Ripley	1,035,925	236,900	0.023%
Saline	2,239,650	131,430	0.006%
Schuyler	377,388	100,167	0.027%
Scotland	463,064	102,809	0.022%
Scott	3,412,660	1,360,391	0.040%
Shannon	561,433	181,180	0.032%
Shelby	644,507	113,498	0.018%
St.Charles	25,189,490	3,052,949	0.012%
St.Clair	793,226	107,221	0.014%
St.Francois	4,506,358	759,339	0.017%
St.Genevieve	1,606,901	14,929,137	0.013%
St.Louis	111,841,233	4,730,737	0.013%
St.LouisCity	35,705,870	321,612	0.020%
Stoddard	2,371,567	763,691	0.032%
Stone	2,795,149	221,780	0.008%
Sullivan	611,691	108,601	0.018%
Taney	4,250,375	368,625	0.009%
Texas	1,926,113	287,621	0.015%
Vernon	1,806,099	132,436	0.007%
Warren	2,116,274	284,604	0.013%
Washington	1,422,677	300,865	0.021%
Wayne	1,129,010	282,819	0.025%
Webster	2,489,343	228,913	0.009%
Worth	231,523	113,195	0.049%
Wright	1,379,829	211,486	0.015%
<b>Total:</b>	<b>533,705,022</b>	<b>49,568,493</b>	

Source: HAZUS-MH

**Table 34. Annual Expected Loss by County due to a 7.6 Earthquake Event (client provided MMI map)**

County	MMI Zone	Residential (\$)	Commercial (\$)	Medical & Hospital (\$)	Industrial (\$)	Agricultural (\$)	Schools (\$)	Govt. (\$)	Emergency (\$)	Religious (\$)	Total (\$)
Adair	7	38,986,111	8,002,804	3,289,089	735,461	703,803	3,717,700	185,854	37,992	1,340,611	56,999,425
Audrain	7	39,825,026	7,451,015	2,918,137	2,951,103	1,055,592	436,107	450,652	43,484	722,885	55,854,002
Boone	7	215,921,157	56,850,633	10,891,699	6,548,382	1,488,802	6,055,449	1,388,025	57,583	5,263,256	304,464,985
Callaway	7	56,868,319	8,069,678	463,587	1,043,473	405,807	1,184,812	261,141	70,439	859,000	69,226,257
Carter	7	8,829,592	1,175,961	142,406	536,554	102,239	465,226	155,019	0	433,918	11,840,915
Chariton	7	14,904,830	2,995,002	75,080	539,710	843,180	148,323	42,201	0	437,312	19,985,638
Clark	7	11,172,422	1,520,215	360,506	189,035	547,884	204,197	51,317	0	155,602	14,201,178
Cole	7	113,461,869	26,195,581	6,318,294	3,604,989	352,746	1,359,160	8,948,847	384,731	4,027,510	164,653,727
Howard	7	15,172,352	1,648,021	99,775	290,029	217,871	248,790	41,695	0	311,789	18,030,321
Iron	7	15,731,703	2,061,417	269,919	530,183	83,783	7,315	41,639	0	758,055	19,484,013
Jefferson	7	281,098	41,032	8,424	9,949	691	6,118	530	67	4,657	352,567
Knox	7	7,865,874	1,158,676	19,955	183,908	693,675	204,113	22,845	0	265,676	10,414,722
Macon	7	24,872,300	3,661,632	853,031	563,911	213,369	158,198	310,263	0	518,595	31,151,301
Madison	7	17,255,965	3,297,067	587,531	1,322,445	256,133	216,689	68,141	28,179	700,940	23,733,090
Monroe	7	14,167,896	1,774,962	98,751	341,741	593,067	214,044	10,691	0	220,968	17,422,119
Montgomery	7	20,309,710	4,223,630	215,584	881,279	752,532	244,373	116,138	0	349,183	27,092,428
Oregon	7	13,920,405	2,910,032	98,809	379,219	289,613	148,211	66,678	17,160	565,527	18,395,654
Putnam	7	8,522,795	1,088,669	150,482	205,967	284,830	26,108	42,145	0	205,577	10,526,572
Randolph	7	36,126,986	8,451,527	2,123,273	3,167,133	516,149	736,270	402,712	39,829	889,957	52,453,836
Reynolds	7	11,974,672	1,174,503	91,173	660,773	83,108	151,981	119,120	0	406,473	14,661,802
Ripley	7	17,563,527	3,181,146	340,493	1,824,007	179,102	242,235	40,626	0	421,220	23,792,355
Schuyler	7	6,511,767	1,056,043	138,661	115,495	689,680	179,102	86,372	0	124,177	8,901,296
Scotland	7	7,547,058	1,876,839	46,844	451,324	583,052	97,232	101,114	0	154,841	10,858,304
Shelby	7	11,047,303	1,746,441	15,215	829,472	530,216	271,044	62,964	0	421,863	14,924,518
St.Charles	7	459,757,511	79,844,434	10,780,425	14,308,305	1,297,265	9,569,204	2,085,301	112,122	6,533,001	584,287,569
St.Francois	7	79,834,409	14,604,123	5,861,261	2,159,722	381,105	594,812	537,531	67,396	1,400,008	105,440,366
St.Genevieve	7	27,401,986	4,367,587	1,865,146	2,397,121	273,239	127,954	169,536	0	538,082	37,140,651

County	MMI Zone	Residential (\$)	Commercial (\$)	Medical & Hospital (\$)	Industrial (\$)	Agricultural (\$)	Schools (\$)	Govt. (\$)	Emergency (\$)	Religious (\$)	Total (\$)
Warren	7	39,244,990	5,440,861	340,200	1,629,347	266,880	509,622	152,881	0	1,209,646	48,794,427
Wayne	7	20,312,344	2,737,554	517,132	1,056,234	169,761	271,551	10,185	30,646	1,010,623	26,116,029
Bollinger	8	80,021,110	11,864,994	378,148	1,711,577	1,712,721	1,800,492	345,022	106,190	3,136,203	101,076,456
Butler	8	283,405,651	80,605,090	21,869,676	12,764,460	6,144,761	6,910,055	1,581,987	548,155	8,056,924	421,886,759
CapeGirardeau	8	519,807,692	134,315,755	19,996,205	17,679,541	2,282,046	7,796,068	2,020,842	637,054	11,332,928	715,868,130
Lewis	8	71,578,014	8,819,483	503,147	832,533	2,716,684	93,043	419,350	0	1,742,030	86,704,284
Lincoln	8	248,555,451	31,654,745	9,138,600	4,402,298	1,618,624	687,144	85,926	0	3,662,238	299,805,027
Marion	8	216,596,580	44,018,722	13,187,622	10,772,116	2,643,937	2,871,008	3,328,709	0	5,616,437	299,035,130
Perry	8	129,929,334	30,722,064	6,821,604	17,671,028	3,475,784	924,758	633,111	195,089	8,950,829	199,323,601
Pike	8	121,162,145	28,364,045	1,198,725	3,730,178	3,664,769	2,671,349	1,730,380	80,380	3,280,390	165,882,360
Ralls	8	71,052,021	9,246,098	95,257	1,131,851	1,916,729	621,250	387,985	0	1,326,191	85,777,380
St.LouisCity	8	2,716,153,332	748,149,497	112,228,143	180,447,802	1,759,374	63,910,203	15,683,070	7,963,218	66,591,335	3,912,885,974
St.Louis	8	8,623,736,848	2,439,428,019	377,989,325	490,242,191	23,124,627	102,142,644	17,813,823	5,656,395	189,600,056	12,269,733,927
Washington	8	124,897,236	15,313,841	1,324,957	3,075,712	891,416	479,446	1,447,299	0	7,075,576	154,505,483
Dunklin	9	542,246,124	104,857,103	10,577,281	15,712,989	7,456,298	4,451,283	2,374,727	86,896	13,093,374	700,856,075
Scott	9	678,397,343	159,915,852	31,177,057	33,401,274	12,559,167	7,164,116	3,805,687	949,465	17,663,180	945,033,142
Stoddard	9	516,947,556	91,447,028	15,524,328	12,334,912	2,845,280	728,791	1,172,056	174,005	10,074,063	651,248,018
Mississippi	10	501,042,046	69,679,561	3,948,666	10,237,701	10,382,860	3,497,261	1,474,855	0	13,098,948	613,361,898
NewMadrid	10	709,352,193	179,480,827	8,796,670	18,991,568	15,608,145	23,359,228	2,659,743	0	19,578,772	977,827,145
Pemiscot	10	695,958,980	123,017,378	19,868,856	15,804,704	92,146,046	12,649,603	6,898,847	1,859,554	23,326,139	991,530,107
<b>TOTAL</b>		<b>18,206,231,634</b>	<b>4,569,507,185</b>	<b>703,605,151</b>	<b>900,400,704</b>	<b>206,804,439</b>	<b>270,553,679</b>	<b>79,835,579</b>	<b>19,146,028</b>	<b>437,456,567</b>	<b>25,393,540,966</b>

Source: HAZUS-MH

**Table 35. Social Impact Estimates by County due to a 7.6 Earthquake Event (client provided MMI map)**

County	County FIPS	MMI Zone	Severity 1	Severity 2	Severity 3	Severity 4	Displaced	Shelter
Adair	29001	7	612	-	-	-	924	286
Audrain	29007	7	630	-	-	-	944	261
Bollinger	29017	8	1,449	363	-	-	2,631	768
Boone	29019	7	3,352	-	-	-	5,116	1,326
Butler	29023	8	5,217	1,335	-	-	9,319	2,831
Callaway	29027	7	869	-	-	-	1,348	335
CapeGirardeau	29031	8	9,300	2,368	-	-	17,092	4,464
Carter	29035	7	136	-	-	-	209	68
Chariton	29041	7	245	-	-	-	353	104
Clark	2045	7	180	-	-	-	265	78
Cole	29051	7	1,765	-	-	-	2,689	644
Dunklin	29069	9	18,441	1,844	112	56	43,452	14,213
Howard	29089	7	233	-	-	-	360	102
Iron	29093	7	240	-	-	-	373	114
Jefferson	29099	7	4,269	-	-	-	6,661	1,481
Knox	29103	7	134	-	-	-	186	59
Lewis	29111	8	1,319	328	-	-	2,354	694
Lincoln	29113	8	4,382	1,091	-	-	8,173	1,935
Macon	29121	7	382	-	-	-	589	172
Madison	29123	7	269	-	-	-	409	127
Marion	29127	8	3,900	987	-	-	7,122	1,975
Mississippi	29133	10	50,632	13,856	3,828	1,800	89,185	30,336
Monroe	29137	7	226	-	-	-	336	98
Montgomery	29139	7	326	-	-	-	481	135
NewMadrid	29143	10	73,020	20,048	2,666	1,812	126,265	40,545
Oregon	29149	7	219	-	-	-	330	112
Pemiscot	29155	10	81,638	22,359	2,956	1,210	123,881	43,385
Perry	29157	8	2,407	616	-	-	4,272	1,113
Pike	29163	8	2,242	569	-	-	3,984	1,145
Putnam	29171	7	135	-	-	-	202	64
Ralls	29173	8	1,290	321	-	-	2,336	605
Randolph	29175	7	565	-	-	-	856	241
Reynolds	29179	7	182	-	-	-	284	91
Ripley	29181	7	271	-	-	-	416	137
Schuyler	29197	7	114	-	-	-	154	49
Scotland	29199	7	128	-	-	-	179	56
Scott	29201	9	23,360	2,336	121	71	54,362	15,720
Shelby	29205	7	179	-	-	-	262	80
St.Charles	29183	7	7,008	-	-	-	10,894	2,115
St.Francois	29187	7	1,223	-	-	-	1,892	536
St.Genevieve	29186	7	422	-	-	-	649	159
St.Louis	29189	8	154,381	39,478	-	-	283,557	63,061
St.LouisCity	29510	8	48,513	12,414	-	-	89,310	29,087
Stoddard	29207	9	17,334	1,733	103	53	41,424	12,662

County	County FIPS	MMI Zone	Severity 1	Severity 2	Severity 3	Severity 4	Displaced	Shelter
Warren	29219	7	600	-	-	-	930	223
Washington	29221	8	2,217	555	-	-	4,107	1,272
Wayne	29223	7	312	-	-	-	481	156
<b>TOTAL</b>			<b>526,269</b>	<b>122,601</b>	<b>9,787</b>	<b>5,002</b>	<b>951,596</b>	<b>275,222</b>

Source: HAZUS-MH

**Table 36. Severity, Displacement, and Shelter Descriptions**

<b>Severity 1</b>	Injuries requiring basic medical aid that could be administered by paraprofessionals. These types of injuries would require bandages or observation. Some examples are: a sprain, a severe cut requiring stitches, a minor burn (first degree or second degree on a small part of the body), or a bump on the head without loss of consciousness. Injuries of lesser severity that could be self-treated are not estimated by HAZUS.
<b>Severity 2</b>	Injuries requiring a greater degree of medical care and use of medical technology such as x-rays or surgery, but not expected to progress to a life threatening status. Some examples are third degree burns or second degree burns over large parts of the body, a bump on the head that causes loss of consciousness, fractured bone, dehydration or exposure.
<b>Severity 3</b>	Injuries that pose an immediate life threatening condition if not treated adequately and expeditiously. Some examples are: uncontrolled bleeding, punctured organ, other internal injuries, spinal column injuries, or crush syndrome.
<b>Severity 4</b>	Instantaneously killed or mortally injured

<b>Displacement</b>	People evacuating their residence due merely to physical damage to the building; note, that, there may be others who need to evacuate for sole reasons of utility service disruption, etc;
	Results taking into account the functionality of a residence depending on its degree of physical damage.

<b>Shelter</b>	People, among the displaced, in need of shelter.
	Results taking into account the influence on choice for shelter based on income level, age group, ethnicity, and ownership.

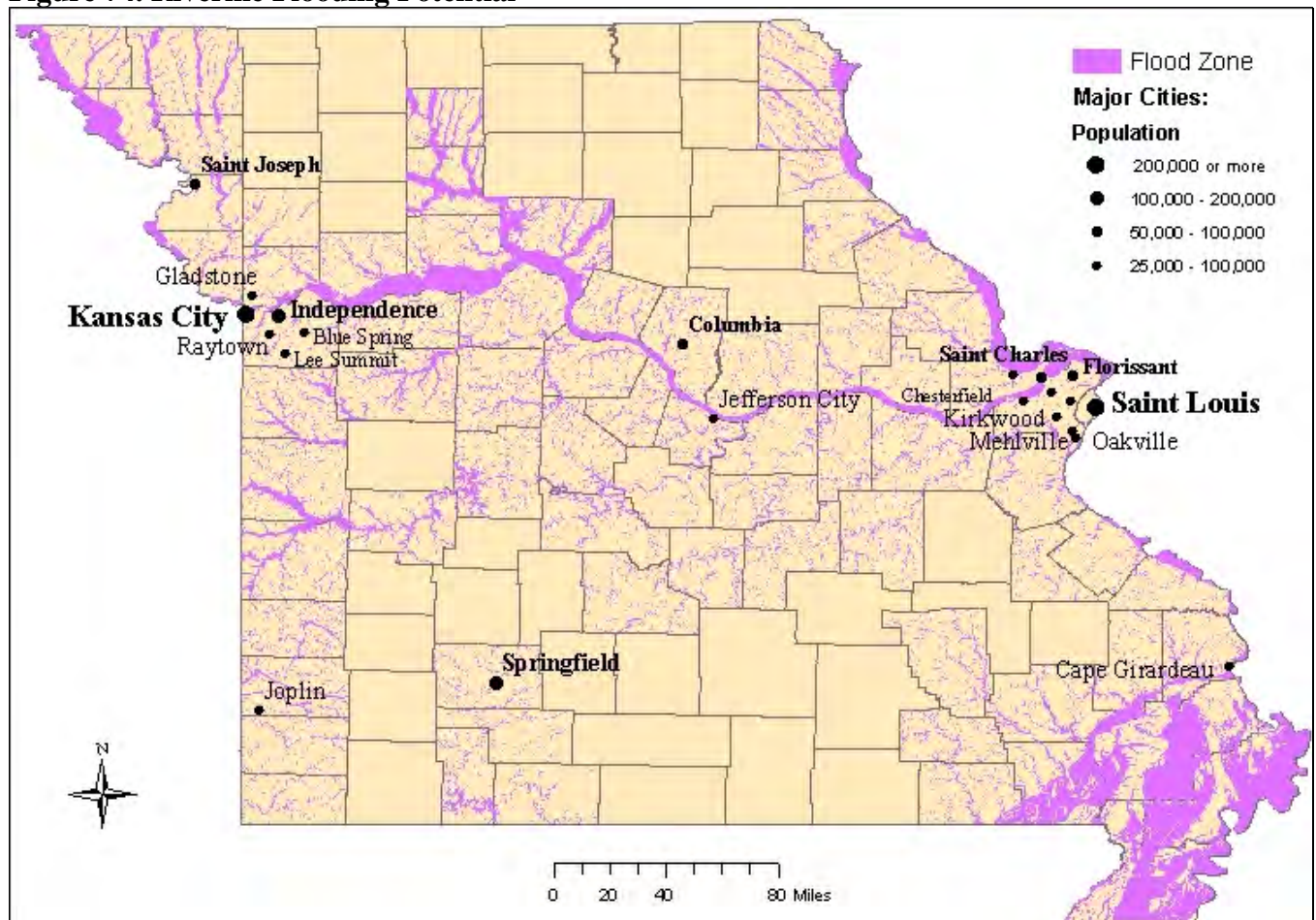
Source: HAZUS-MH

### 3.3.2 Riverine Flooding

In order to assess flood risk, flood areas were modeled for 100-year and 500-year events. Flood depth was estimated at the pixel level for affected areas, along with proportion of the area affected within the census block. HAZUS-MH inventory was then utilized to estimate exposure. **Figure 74** illustrates the riverine flooding potential for all counties in the state of Missouri. Flood loss analysis was conducted for the following major cities in Missouri that are densely populated: Cape Girardeau, Kansas City, Springfield, St. Louis City, St. Charles, and Jefferson.



**Figure 74. Riverine Flooding Potential**



**Table 37** shows the estimated annual expected loss and affected people at risk to flooding for seven metropolitan areas in the State of Missouri that are densely populated. The St. Louis unincorporated area has the greatest number of residential and commercial buildings that are susceptible to potential flood loss and population at risk to injury, mortality, or displacement.

**Table 37. Potential Affected Exposure for 100-Year Flood (Riverine Flooding)**

City	County Name	County FIPS	Potential Residential Building Exposure Risk (\$1,000)		Potential Commercial Building Exposure Risk (\$1,000)		People at Risk
			Number	Value	Number	Value	
Cape Girardeau	Cape Girardeau	29031	1495	336,055	58	214,419	4,513
Kansas City	Jackson	29095	4450	1,133,635	132	596,061	14,296
Springfield	Green	29007	1733	414,287	26	125,944	5,620
St. Louis*	St. Louis	29189	11918	3,241,512	302	1,217,357	40,652
St Louis City	St Louis City	29510	777	187,740	4	22,484	2,430
St. Charles	St. Charles	29183	5574	1,270,905	64	268,334	17,454
Jefferson	Cole	29051	1091	267,026	8	46,704	4,199
<b>TOTAL</b>			<b>27,038</b>	<b>6,851,160</b>	<b>594</b>	<b>2,491,302</b>	<b>89,164</b>

Source: HAZUS-MH

\*Unincorporated

### 3.3.3 Tornado

Tornadoes are quite frequent in the state of Missouri. On average, about 26 tornadoes annually touch down somewhere in the state. Although, tornadoes can occur anytime during the year, they are most likely to occur in the spring. Tornadoes have been both sources of imposing physical and monetary damage and injury and death in the state.

#### NOAA Data

This statistical risk assessment methodology used NOAA reported data, which covers all reported tornado losses from 1950 to 2002. It is important to realize that many tornadoes that might have occurred in uninhabited areas, as well as some inhabited areas, have not been reported. The incompleteness of the data suggests that it is not appropriate for use in parametric modeling. A parametric model can be developed based on a combination, or rather a convolution, of many physical models to predict future expected losses. Such a model is based on the physical parameters of the characteristic tornadoes, as well as the exposure and inventory, at the time that losses and risks were estimated.

The statistical model used for this assessment is probabilistic. It is based on past experience and forecasts the expected results for the immediate or extended future. It is independent of physical parameters such as tornado event frequency, intensity, track, exposure, and building vulnerability. NOAA data, only for recent years, can show a realistic frequency distribution of different Fujita scales.

## Methodology

The following steps were required to prepare the NOAA data for use with the methodology:

Data cleansing:

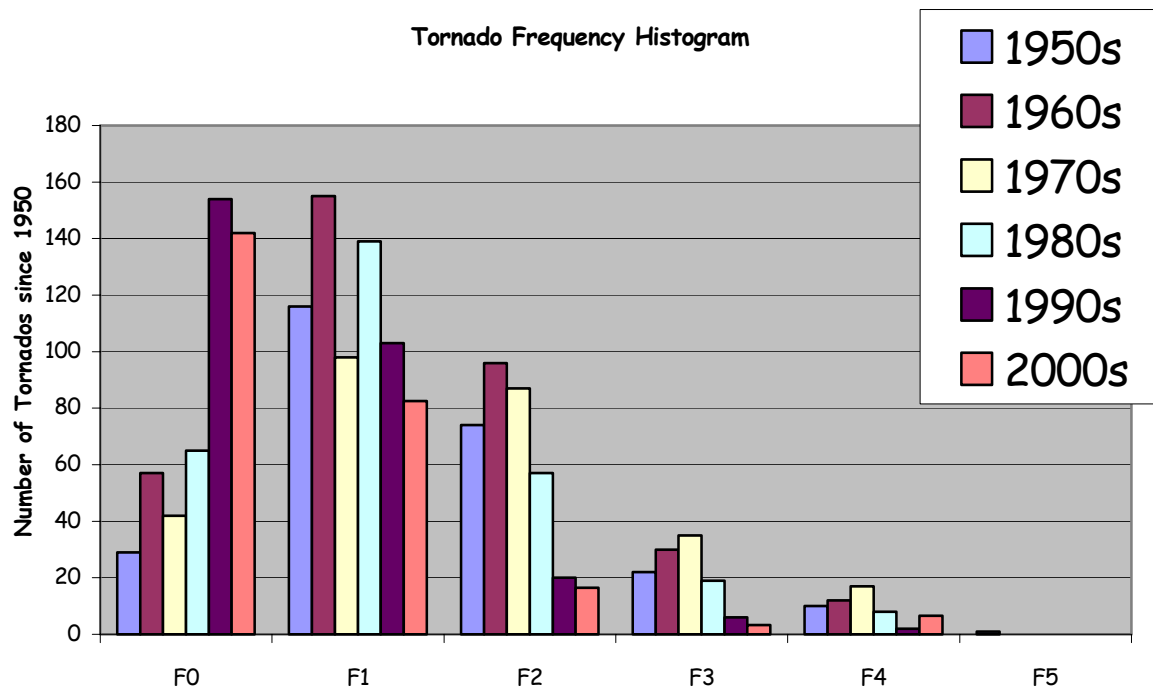
- Delete duplicate data that are reported by more than one jurisdiction.
- Delete data that are irrelevant to tornados (e.g., damage to lightning, thunderstorm, etc.)

Data adjustment:

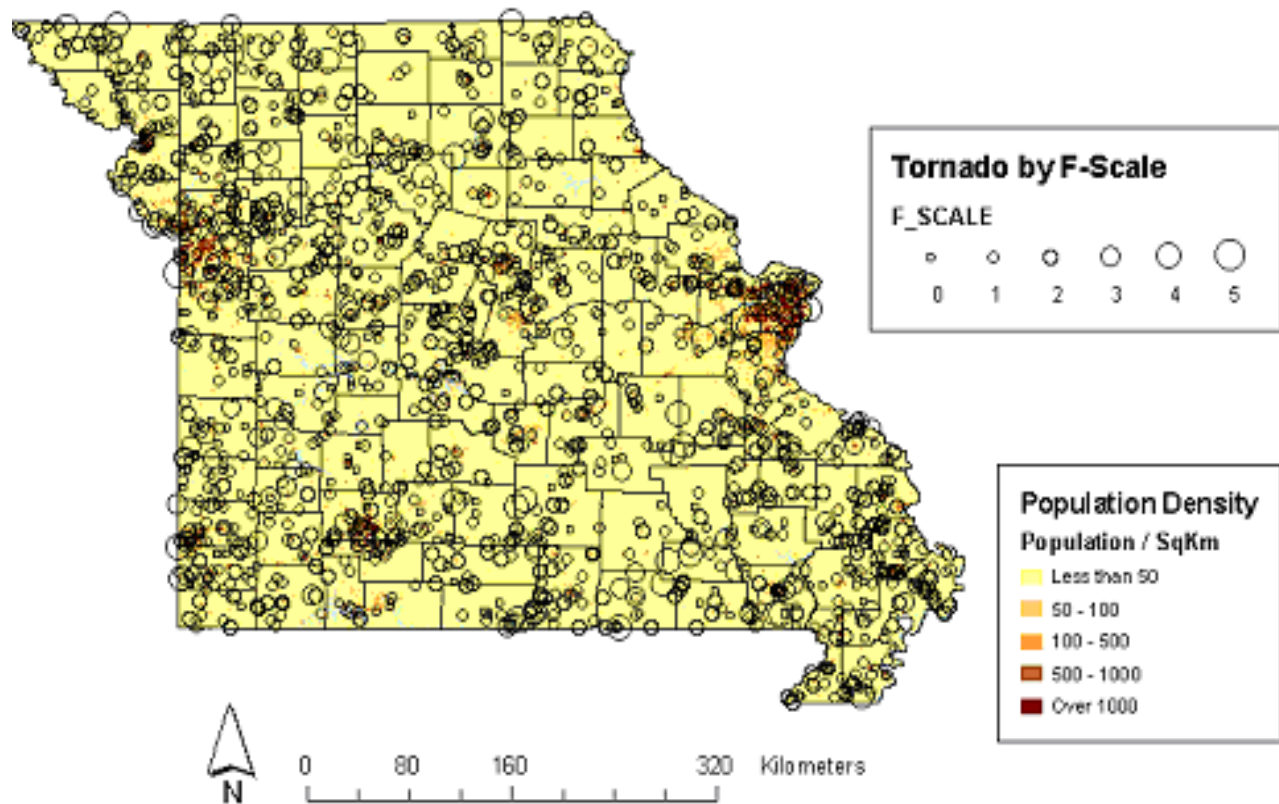
- The NOAA data is already adjusted for inflation and other economical effects.
- Observed losses were modified for increased or decreased level of exposure with regard to population growth history. Artificial occurrences of tornadoes were added to account for a disproportionate amount of occurrences that were not reported, based on an analysis of data in recent years. In addition, loss numbers were inflated (to normalize costs to current inventory and exposure values), which was assumed to increase proportionally with population growth. Finally, the gradual decrease in the vulnerability of structures was considered (e.g., due to code upgrades/compliance, hazard mitigation, and the process of natural selection whereby some older construction survives over longer periods of time than others).

**Figure 75** illustrates the frequency of tornadoes by decade since 1950 and reveals that older NOAA data (e.g., 1950s and 1960s) is poor reporting lower intensity tornados that likely have produced (noticeable) losses. **Figure 76** presents a map of the reported historical tornados that have impacted Missouri counties. The map illustrates a strong correlation between the occurrences of reported tornados in areas of high population density.

**Figure 75. Tornado Frequency Histogram**



**Figure 76. Historical Tornado Events (NOAA Data 1950 - 2003)**



**Table 38** shows the estimated annualized expected property losses due to tornadoes by county.

**Table 38. Estimated Annualized Expected Property Loss due to Tornado**

County	Estimated Annualized Expected Tornado Loss (\$)
Adair	4,912
Andrew	193,798
Atchison	85,436
Audrain	176,904
Barry	287,336
Barton	868,587
Bates	38,756
Benton	199,604
Bollinger	20,865
Boone	1,113,219
Buchanan	114,193
Butler	441,063
Caldwell	149,862
Callaway	34,763
Camden	224,918
CapeGirardeau	149,327
Carroll	123,760
Carter	474,766
Cass	1,994,774
Cedar	1,058,019
Chariton	252,707
Christian	659
Clark	138,531
Clay	346,803
Clinton	43,182
Cole	313,637
Cooper	49,675
Crawford	1,654,178
Dade	86,626
Dallas	3,217
Daviess	91,760
DeKalb	18,518
Dent	30,523
Douglas	191,609
Dunklin	702,517
Franklin	345,852
Gasconade	1,195,623
Gentry	13,675
Greene	2,319,954
Grundy	16,028
Harrison	221,986
Henry	153,268
Hickory	24,335
Holt	892

County	Estimated Annualized Expected Tornado Loss (\$)
Howard	15,720
Howell	1,188,998
Iron	145,782
Jackson	1,092,996
Jasper	740,474
Jefferson	305,239
Johnson	50,270
Knox	28,408
Laclede	158,036
Lafayette	119,824
Lawrence	143,777
Lewis	80,400
Lincoln	51,336
Linn	167,248
Livingston	9,879
Macon	301,626
Madison	36,578
Maries	13,516
Marion	9,381
McDonald	45,241
Mercer	104,966
Miller	161,738
Mississippi	675,548
Moniteau	932,952
Monroe	1,232
Montgomery	20,539
Morgan	34,465
NewMadrid	693,525
Newton	1,272,114
Nodaway	207,767
Oregon	310,566
Osage	125,179
Ozark	986,506
Pemiscot	65,285
Perry	1,097,858
Pettis	2,022,336
Phelps	174,325
Pike	19,148
Platte	750,823
Polk	196,857
Pulaski	326,373
Putnam	670
Ralls	247,542
Randolph	20,835

County	Estimated Annualized Expected Tornado Loss (\$)
Ray	409,211
Reynolds	19,786
Ripley	184,417
Saline	28,685
Schuyler	113,826
Scotland	18,193
Scott	1,005,917
Shannon	135,915
Shelby	116,400
St.Charles	1,824,443
St.Clair	1,040,403
St.Francois	1,202,684
St.Genevieve	989,521
St.Louis	417,499
St.LouisCity	10,676

County	Estimated Annualized Expected Tornado Loss (\$)
Stoddard	146,504
Stone	48,565
Sullivan	1,482
Taney	32,154
Texas	354,952
Vernon	974,917
Warren	257,404
Washington	2,231,945
Wayne	123,703
Webster	230,000
Worth	12,879
Wright	301,622
<b>TOTAL</b>	<b>43,358,200</b>

Source: HAZUS-MH

### 3.4 Assessing Vulnerability Of State Facilities

**44 CFR 201.4(c)(2)(ii) – The risk assessment shall include an overview and analysis of the State’s vulnerability to the hazards described in this paragraph (c)(2), based on estimates provided in the State risk assessment. State owned or operated critical facilities located in the identified hazard areas shall also be addressed.**

As the State of Missouri remains vulnerable to natural hazards, state-owned facilities are equally at risk to incur damages due to hazard occurrences. However, the state’s resources, both monetary and fixed assets, depend heavily upon these facilities and their continuity

Due to Homeland Security requirements, critical facilities were not analyzed in this risk assessment but are included in the State Terrorism Plan. However, State High Priority facilities were assessed for potential vulnerability to earthquake, flooding, and tornado hazards. These facilities may not be considered as "Critical" in the sense of the facilities being identified in other plans, but they are very important to SEMA from a mitigation planning perspective. All of the State High Priority Facilities have not been geocoded. Therefore, only those that have been georeferenced at this time have been included in this analysis. **Table 39** includes the state agencies that were included in this analysis as well as the acronyms that are used throughout this study. **Table 40** shows the number of all the state facilities and replacement value of facilities by agency. Currently, two state agency facilities are under construction in Jefferson City, which should be noted for future risk and vulnerability assessment activities and eventually will raise to 67 the total number of facilities exposed: the Department of Corrections Algoa Correctional Facility and the Department of Natural Resources State Health Lab.

**Table 39. State Agency Acronyms**

Acronym	State Agency
AG	Missouri Attorney General's Offices
DHS	Department of Health and Senior Services
DMH	Department of Mental Health
DOC	Department of Corrections
DOT	Department of Transportation
DPS	Department of Public Safety - Missouri Highway Patrol
GOV	Governor's Office
MULT	Multiple
STO	State Treasurer's Office



**Table 40. Dollar Exposure of All State High Priority Facilities by Agency**

Acronym	Number of Facilities	Usage	Replacement Value
AG	2	General Office	34,945,067
DHS	1	Main Office	4,800,509
DMH	22	Main Office/Clinics	738,018,325
DOC	14	Main Office/Prisons	1,023,088,314
DOT	9	Main Office/District Offices	24,989,712
DPS	13	Headquarters/Troops	41,488,402
GOV	2	State Offices	702,265,900
MULT	1	State Offices	93,861,820
STO	1	Main Office	27,187,858
<b>TOTAL</b>	<b>65</b>		<b>2,690,645,907</b>

Source: HAZUS-MH

### 3.4.1 Earthquake

**Table 41** shows the number of State High Priority Facilities that would be susceptible to suffering at least slight damage from an earthquake with a 100-year and a 500-year recurrence interval.

**Table 41. Distribution of State High Priority Facilities Vulnerable to Earthquake**

Acronym	County	Number of Facilities - 100-year Earthquake	Number of Facilities - 500-year Earthquake
AG	Cole	0	1
AG	Saint Louis	1	1
DHS	Cole	0	1
DMH	Adair	0	1
DMH	Butler	1	1
DMH	Callaway	0	1
DMH	Cape Girardeau	1	1
DMH	Cole	0	1
DMH	Gentry	0	1
DMH	Greene	0	1
DMH	Jackson	0	1
DMH	Jasper	0	1
DMH	Lafayette	0	1
DMH	Marion	0	1
DMH	Phelps	0	1
DMH	Saint Francois	1	1
DMH	Saint Louis	6	1
DMH	Saline	0	1
DMH	Scott	1	1
DMH	Vernon	0	1
DOC	Audrain	0	1
DOC	Buchanan	0	1
DOC	Cole	0	1
DOC	Cooper	0	1

<b>Acronym</b>	<b>County</b>	<b>Number of Facilities - 100-year Earthquake</b>	<b>Number of Facilities - 500-year Earthquake</b>
DOC	Dakalb	0	1
DOC	Livingston	0	1
DOC	Pike	0	1
DOC	Randolph	0	1
DOC	Saint Francois	0	1
DOC	Saint Louis	1	1
DOC	Washington	1	1
DOC	Webster	0	1
DOT	Buchanan	0	1
DOT	Cole	0	1
DOT	Greene	0	1
DOT	Howell	0	1
DOT	Jackson	0	1
DOT	Jasper	0	1
DOT	Marion	0	1
DOT	Saint Louis	1	1
DOT	Scott	1	1
DPS	Buchanan	0	1
DPS	Butler	1	1
DPS	Cole	0	0
DPS	Greene	0	1
DPS	Jackson	0	1
DPS	Macon	0	1
DPS	Saint Louis	1	1
GOV	Cole	0	1
MULT	Cole	0	1
STO	Jackson	0	1
<b>TOTAL</b>		<b>17</b>	<b>50</b>

### 3.4.2 Riverine Flooding

Although, flooding is a major hazard in the State of Missouri, current available data suggests that most State High Priority Facilities do not appear to be susceptible to flood damage, with the notable exception of the current State Health Lab. To remedy that problem, a new State Health Lab facility currently is being built in an area that is not in the floodplain.

### 3.4.3 Tornado

Historical evidence shows that most of the area is vulnerable to tornadic activity. This hazard can result from severe thunderstorm activity or may occur during a major tropical storm or hurricane. Because it cannot be predicted where a tornado may touch down, all buildings and facilities are considered to be exposed to this hazard and could potentially be impacted. **Table 42** lists the number of State High Priority Facilities by agency and county that might suffer at least slight damage due to tornadic activity or severe winds.

**Table 42. Distribution of State High Priority Facilities Vulnerable to Tornado by County**

Acronym	County	Total
AG	Cole	1
AG	Saint Louis	1
DHS	Cole	1
DMH	Adair	1
DMH	Butler	1
DMH	Callaway	1
DMH	Cape Girardeau	1
DMH	Cole	1
DMH	Gentry	1
DMH	Greene	1
DMH	Jackson	2
DMH	Jasper	1
DMH	Lafayette	1
DMH	Marion	1
DMH	Phelps	1
DMH	Saint Francois	1
DMH	Saint Louis	6
DMH	Saline	1
DMH	Scott	1
DMH	Vernon	1
DOC	Audrain	1
DOC	Buchanan	1
DOC	Cole	3
DOC	Cooper	1
DOC	Dakalb	2
DOC	Livingston	1
DOC	Pike	1
DOC	Randolph	1
DOC	Saint Francois	1

Acronym	County	Total
DOC	Saint Louis	1
DOC	Washington	1
DOC	Webster	1
DOT	Buchanan	1
DOT	Cole	1
DOT	Greene	1
DOT	Howell	1
DOT	Jackson	1
DOT	Jasper	1
DOT	Marion	1
DOT	Saint Louis	1
DOT	Scott	1
DPS	Buchanan	1
DPS	Butler	1
DPS	Cole	7
DPS	Greene	1
DPS	Jackson	1
DPS	Macon	1
DPS	Saint Louis	1
GOV	Cole	2
MULT	Cole	1
STO	Jackson	1
<b>TOTAL</b>		<b>67</b>

### 3.5 Estimating Potential Losses By Jurisdiction

**44 CFR 201.4(c)(2)(iii) – The risk assessment shall include an overview and analysis of potential losses to identified vulnerable structures, based on estimates provided in local risk assessments.**

#### **Loss Estimates**

SEMA has been involved with all counties and major metropolitan areas in developing risk assessments over a number of years in the State 409 plan, local operations plans, Project Impact mitigation plans, and mitigation projects throughout the state. As new information becomes available through ongoing mitigation planning at the local level, SEMA will continue to use the information to evaluate the accuracy of and to update the State Hazard Mitigation Plan. Risk Assessment is presented for annualized losses, whenever possible. In general, presenting results in the annualized form is very useful on three fronts:

- Contribution of potential losses from all (long term) future disasters is accounted for with this approach.
- Results in this form from different hazards are readily comparable and hence easier to rank.
- When evaluating mitigation alternatives, use of annualized losses is an objective approach for this purpose.

Annualized losses for the hazards where the parametric approach is utilized are computed automatically using a probabilistic approach.

For the other hazards where the statistical approach was used, the computations are based primarily on the observed historical losses.

#### **Economic Impact**

Using the previously described methodology, results were obtained for the different hazards profiled earlier. The economic results are summarized in **Tables 43 - 46**.

The economic loss results are presented here using two interrelated risk indicators:

1. The Annualized Expected Loss (AEL), which is the estimated expected long-term value of losses to the general building stock for the parametric methodology, and to the property for the statistical method in a specified geographic area (i.e., county)
2. The Annualized Loss Ratio (ALR), which expresses estimated annualized loss as a fraction of the building inventory replacement value

The estimated AL addresses the two key components of risk: the probability of hazard occurring in the study area and the consequences of the hazard, largely a function of building construction type and quality, and of the intensity of the hazard event. By annualizing estimated losses, the AL factors in historic patterns of frequent smaller events with infrequent but larger events to provide a balanced presentation of the risk.

The ALR represents the AL as a fraction of the replacement value of the local building inventory. The annualized loss ratio gauges the relationship between average annualized loss

and building replacement value. This ratio can be used as a measure of relative risk between areas and, since it is normalized by replacement value, it can be directly compared across different geographic units such as metropolitan areas or counties.

**Table 43. Summary of the Economic Loss Estimates due to Earthquake and Tornado (Severe Wind)**

County	Annualized Earthquake Loss (\$)	Estimated Annualized Tornado (Severe Wind) Loss (\$)
Adair	26,857	4,912
Andrew	10,652	193,798
Atchison	8,276	85,436
Audrain	90,195	176,904
Barry	100,552	287,336
Barton	21,479	868,587
Bates	22,688	38,756
Benton	49,031	199,604
Bollinger	173,122	20,865
Boone	419,820	1,113,219
Buchanan	92,324	114,193
Butler	706,525	441,063
Caldwell	17,088	149,862
Callaway	138,369	34,763
Camden	242,949	224,918
CapeGirardeau	1,624,582	149,327
Carroll	26,907	123,760
Carter	93,227	474,766
Cass	87,555	1,994,774
Cedar	41,904	1,058,019
Chariton	32,376	252,707
Christian	186,181	659
Clark	30,972	138,531
Clay	213,387	346,803
Clinton	38,477	43,182
Cole	319,410	313,637
Cooper	60,337	49,675
Crawford	249,765	1,654,178
Dade	43,218	86,626
Dallas	68,761	3,217
Daviess	34,855	91,760
DeKalb	36,756	18,518
Dent	191,157	30,523
Douglas	98,765	191,609
Dunklin	799,944	702,517
Franklin	956,328	345,852
Gasconade	150,642	1,195,623
Gentry	41,208	13,675
Greene	1,002,444	2,319,954
Grundy	45,521	16,028

County	Annualized Earthquake Loss (\$)	Estimated Annualized Tornado (Severe Wind) Loss (\$)
Harrison	44,431	221,986
Henry	74,194	153,268
Hickory	62,899	24,335
Holt	48,217	892
Howard	60,623	15,720
Howell	397,018	1,188,998
Iron	172,883	145,782
Jackson	801,760	1,092,996
Jasper	223,819	740,474
Jefferson	2,160,898	305,239
Johnson	115,666	50,270
Knox	56,699	28,408
Laclede	183,769	158,036
Lafayette	88,217	119,824
Lawrence	131,146	143,777
Lewis	70,286	80,400
Lincoln	264,953	51,336
Linn	69,970	167,248
Livingston	70,190	9,879
Macon	94,078	301,626
Madison	79,289	36,578
Maries	203,076	13,516
Marion	110,157	9,381
McDonald	146,376	45,241
Mercer	65,933	104,966
Miller	142,380	161,738
Mississippi	524,778	675,548
Moniteau	100,034	932,952
Monroe	87,177	1,232
Montgomery	135,488	20,539
Morgan	139,534	34,465
NewMadrid	760,857	693,525
Newton	160,775	1,272,114
Nodaway	88,085	207,767
Oregon	191,659	310,566
Osage	152,987	125,179
Ozark	152,322	986,506
Pemiscot	773,002	65,285
Perry	370,630	1,097,858
Pettis	151,883	2,022,336
Phelps	391,020	174,325
Pike	156,252	19,148
Platte	151,849	750,823
Polk	145,330	196,857
Pulaski	342,860	326,373
Putnam	87,894	670
Ralls	110,852	247,542

County	Annualized Earthquake Loss (\$)	Estimated Annualized Tornado (Severe Wind) Loss (\$)
Randolph	135,729	20,835
Ray	106,285	409,211
Reynolds	185,671	19,786
Ripley	236,900	184,417
Saline	3,052,949	28,685
Schuyler	107,221	113,826
Scotland	321,612	18,193
Scott	759,339	1,005,917
Shannon	14,929,137	135,915
Shelby	131,430	116,400
St.Charles	100,167	1,824,443
St.Clair	102,809	1,040,403
St.Francois	1,360,391	1,202,684
St.Genevieve	181,180	989,521
St.Louis	113,498	417,499
St.LouisCity	763,691	10,676
Stoddard	221,780	146,504
Stone	108,601	48,565
Sullivan	368,625	1,482
Taney	287,621	32,154
Texas	132,436	354,952
Vernon	284,604	974,917
Warren	300,865	257,404
Washington	282,819	2,231,945
Wayne	228,913	123,703
Webster	113,195	230,000
Worth	211,486	12,879
Wright	4,730,737	301,622
<b>Total</b>	<b>49,568,493</b>	<b>43,358,200</b>

Source: HAZUS-MH

**Table 44. Economic Loss Ratios due to Earthquake**

County	Percent Loss Ratio (%)
Adair	0.001%
Andrew	0.001%
Atchison	0.001%
Audrain	0.004%
Barry	0.003%
Barton	0.002%
Bates	0.002%
Benton	0.003%
Bollinger	0.019%
Boone	0.003%
Buchanan	0.001%
Butler	0.019%
Caldwell	0.003%
Callaway	0.005%
Camden	0.004%
CapeGirardeau	0.025%
Carroll	0.003%
Carter	0.018%
Cass	0.001%
Cedar	0.004%
Chariton	0.004%
Christian	0.004%
Clark	0.005%
Clay	0.001%
Clinton	0.002%
Cole	0.005%
Cooper	0.004%
Crawford	0.013%
Dade	0.007%
Dallas	0.006%
Daviess	0.005%
DeKalb	0.005%
Dent	0.015%
Douglas	0.011%
Dunklin	0.031%
Franklin	0.012%
Gasconade	0.010%
Gentry	0.006%
Greene	0.004%
Grundy	0.005%
Harrison	0.005%
Henry	0.004%
Hickory	0.008%
Holt	0.009%

County	Percent Loss Ratio (%)
Howard	0.008%
Howell	0.014%
Iron	0.021%
Jackson	0.001%
Jasper	0.002%
Jefferson	0.014%
Johnson	0.002%
Knox	0.013%
Laclede	0.007%
Lafayette	0.003%
Lawrence	0.005%
Lewis	0.009%
Lincoln	0.010%
Linn	0.006%
Livingston	0.005%
McDonald	0.006%
Macon	0.006%
Madison	0.020%
Maries	0.016%
Marion	0.005%
Mercer	0.019%
Miller	0.007%
Mississippi	0.052%
Moniteau	0.009%
Monroe	0.012%
Montgomery	0.012%
Morgan	0.006%
NewMadrid	0.048%
Newton	0.004%
Nodaway	0.004%
Oregon	0.024%
Osage	0.011%
Ozark	0.018%
Pemiscot	0.048%
Perry	0.020%
Pettis	0.004%
Phelps	0.012%
Pike	0.010%
Platte	0.002%
Polk	0.007%
Pulaski	0.010%
Putnam	0.019%
Ralls	0.014%
Randolph	0.006%



County	Percent Loss Ratio (%)
Ray	0.006%
Reynolds	0.029%
Ripley	0.023%
St.Charles	0.012%
St.Clair	0.014%
St.Genevieve	0.020%
St.Francois	0.017%
St.Louis	0.013%
Saline	0.006%
Schuyler	0.027%
Scotland	0.022%
Scott	0.040%
Shannon	0.032%
Shelby	0.018%
Stoddard	0.032%
Stone	0.008%
Sullivan	0.018%
Taney	0.009%
Texas	0.015%
Vernon	0.007%
Warren	0.013%
Washington	0.021%
Wayne	0.025%
Webster	0.009%
Worth	0.049%
Wright	0.015%
St.LouisCity	0.013%

Source: HAZUS-MH

**Table 45. Annual Expected Loss by County due to a 7.6 Earthquake Event (client provided MMI map)**

County	MMI Zone	Residential (\$)	Commercial (\$)	Medical & Hospital (\$)	Industrial (\$)	Agricultural (\$)	Schools (\$)	Government (\$)	Emergency (\$)	Religious (\$)	Total (\$)
Adair	7	38,986,111	8,002,804	3,289,089	735,461	703,803	3,717,700	185,854	37,992	1,340,611	56,999,425
Audrain	7	39,825,026	7,451,015	2,918,137	2,951,103	1,055,592	436,107	450,652	43,484	722,885	55,854,002
Boone	7	215,921,157	56,850,633	10,891,699	6,548,382	1,488,802	6,055,449	1,388,025	57,583	5,263,256	304,464,985
Callaway	7	56,868,319	8,069,678	463,587	1,043,473	405,807	1,184,812	261,141	70,439	859,000	69,226,257
Carter	7	8,829,592	1,175,961	142,406	536,554	102,239	465,226	155,019	0	433,918	11,840,915
Chariton	7	14,904,830	2,995,002	75,080	539,710	843,180	148,323	42,201	0	437,312	19,985,638
Clark	7	11,172,422	1,520,215	360,506	189,035	547,884	204,197	51,317	0	155,602	14,201,178
Cole	7	113,461,869	26,195,581	6,318,294	3,604,989	352,746	1,359,160	8,948,847	384,731	4,027,510	164,653,727
Howard	7	15,172,352	1,648,021	99,775	290,029	217,871	248,790	41,695	0	311,789	18,030,321
Iron	7	15,731,703	2,061,417	269,919	530,183	83,783	7,315	41,639	0	758,055	19,484,013
Jefferson	7	281,098	41,032	8,424	9,949	691	6,118	530	67	4,657	352,567
Knox	7	7,865,874	1,158,676	19,955	183,908	693,675	204,113	22,845	0	265,676	10,414,722
Macon	7	24,872,300	3,661,632	853,031	563,911	213,369	158,198	310,263	0	518,595	31,151,301
Madison	7	17,255,965	3,297,067	587,531	1,322,445	256,133	216,689	68,141	28,179	700,940	23,733,090
Monroe	7	14,167,896	1,774,962	98,751	341,741	593,067	214,044	10,691	0	220,968	17,422,119
Montgomery	7	20,309,710	4,223,630	215,584	881,279	752,532	244,373	116,138	0	349,183	27,092,428
Oregon	7	13,920,405	2,910,032	98,809	379,219	289,613	148,211	66,678	17,160	565,527	18,395,654
Putnam	7	8,522,795	1,088,669	150,482	205,967	284,830	26,108	42,145	0	205,577	10,526,572
Randolph	7	36,126,986	8,451,527	2,123,273	3,167,133	516,149	736,270	402,712	39,829	889,957	52,453,836
Reynolds	7	11,974,672	1,174,503	91,173	660,773	83,108	151,981	119,120	0	406,473	14,661,802
Ripley	7	17,563,527	3,181,146	340,493	1,824,007	179,102	242,235	40,626	0	421,220	23,792,355
Schuyler	7	6,511,767	1,056,043	138,661	115,495	689,680	179,102	86,372	0	124,177	8,901,296
Scotland	7	7,547,058	1,876,839	46,844	451,324	583,052	97,232	101,114	0	154,841	10,858,304
Shelby	7	11,047,303	1,746,441	15,215	829,472	530,216	271,044	62,964	0	421,863	14,924,518
St.Charles	7	459,757,511	79,844,434	10,780,425	14,308,305	1,297,265	9,569,204	2,085,301	112,122	6,533,001	584,287,569

County	MMI Zone	Residential (\$)	Commercial (\$)	Medical & Hospital (\$)	Industrial (\$)	Agricultural (\$)	Schools (\$)	Government (\$)	Emergency (\$)	Religious (\$)	Total (\$)
St.Francois	7	79,834,409	14,604,123	5,861,261	2,159,722	381,105	594,812	537,531	67,396	1,400,008	105,440,366
St.Genevieve	7	27,401,986	4,367,587	1,865,146	2,397,121	273,239	127,954	169,536	0	538,082	37,140,651
Warren	7	39,244,990	5,440,861	340,200	1,629,347	266,880	509,622	152,881	0	1,209,646	48,794,427
Wayne	7	20,312,344	2,737,554	517,132	1,056,234	169,761	271,551	10,185	30,646	1,010,623	26,116,029
Bollinger	8	80,021,110	11,864,994	378,148	1,711,577	1,712,721	1,800,492	345,022	106,190	3,136,203	101,076,456
Butler	8	283,405,651	80,605,090	21,869,676	12,764,460	6,144,761	6,910,055	1,581,987	548,155	8,056,924	421,886,759
CapeGirardeau	8	519,807,692	134,315,755	19,996,205	17,679,541	2,282,046	7,796,068	2,020,842	637,054	11,332,928	715,868,130
Lewis	8	71,578,014	8,819,483	503,147	832,533	2,716,684	93,043	419,350	0	1,742,030	86,704,284
Lincoln	8	248,555,451	31,654,745	9,138,600	4,402,298	1,618,624	687,144	85,926	0	3,662,238	299,805,027
Marion	8	216,596,580	44,018,722	13,187,622	10,772,116	2,643,937	2,871,008	3,328,709	0	5,616,437	299,035,130
Perry	8	129,929,334	30,722,064	6,821,604	17,671,028	3,475,784	924,758	633,111	195,089	8,950,829	199,323,601
Pike	8	121,162,145	28,364,045	1,198,725	3,730,178	3,664,769	2,671,349	1,730,380	80,380	3,280,390	165,882,360
Ralls	8	71,052,021	9,246,098	95,257	1,131,851	1,916,729	621,250	387,985	0	1,326,191	85,777,380
St.LouisCity	8	2,716,153,332	748,149,497	112,228,143	180,447,802	1,759,374	63,910,203	15,683,070	7,963,218	66,591,335	3,912,885,974
St.Louis	8	8,623,736,848	2,439,428,019	377,989,325	490,242,191	23,124,627	102,142,644	17,813,823	5,656,395	189,600,056	12,269,733,927
Washington	8	124,897,236	15,313,841	1,324,957	3,075,712	891,416	479,446	1,447,299	0	7,075,576	154,505,483
Dunklin	9	542,246,124	104,857,103	10,577,281	15,712,989	7,456,298	4,451,283	2,374,727	86,896	13,093,374	700,856,075
Scott	9	678,397,343	159,915,852	31,177,057	33,401,274	12,559,167	7,164,116	3,805,687	949,465	17,663,180	945,033,142
Stoddard	9	516,947,556	91,447,028	15,524,328	12,334,912	2,845,280	728,791	1,172,056	174,005	10,074,063	651,248,018
Mississippi	10	501,042,046	69,679,561	3,948,666	10,237,701	10,382,860	3,497,261	1,474,855	0	13,098,948	613,361,898
NewMadrid	10	709,352,193	179,480,827	8,796,670	18,991,568	15,608,145	23,359,228	2,659,743	0	19,578,772	977,827,145
Pemiscot	10	695,958,980	123,017,378	19,868,856	15,804,704	92,146,046	12,649,603	6,898,847	1,859,554	23,326,139	991,530,107
<b>TOTAL</b>		<b>18,206,231,634</b>	<b>4,569,507,185</b>	<b>703,605,151</b>	<b>900,400,704</b>	<b>206,804,439</b>	<b>270,553,679</b>	<b>79,835,579</b>	<b>19,146,028</b>	<b>437,456,567</b>	<b>25,393,540,966</b>

Source: HAZUS-MH

**Table 46. Estimated Loss due to a 100-year Flood**

Estimated Loss - 100-year Flood				Residential (\$1,000)			
City	County Name	County FIPS	Residential Population	Building Count	Exposure	Losses	Percent Loss Ratio
Cape Girardeau	Cape Girardeau	29031	4,513	1495	336055	29893	9%
Kansas City	Jackson	29095	14,296	4450	1133635	81251	7%
Springfield	Green	29007	5,620	1733	414287	25251	6%
St. Louis*	St. Louis	29189	40,652	11918	3241512	311431	10%
St Louis City	St Louis City	29510	2,430	777	187740	20200	11%
St. Charles	St. Charles	29183	17,454	5574	1270905	149675	12%
Jefferson	Cole	29051	4,199	1091	267026	56390	21%
Estimated Loss - 100-year Flood				Commercial (\$1,000)			
City	County Name	County FIPS	Residential Population	Building Count	Exposure	Losses	Percent Loss Ratio
Cape Girardeau	Cape Girardeau	29031	4,513	58	214419	55681	26%
Kansas City	Jackson	29095	14,296	132	596061	85770	14%
Springfield	Green	29007	5,620	26	125944	11067	9%
St. Louis*	St. Louis	29189	40,652	302	1217357	246724	20%
St Louis City	St Louis City	29510	2,430	4	22484	2935	13%
St. Charles	St. Charles	29183	17,454	64	268334	67078	25%
Jefferson	Cole	29051	4,199	8	46704	10124	22%
Estimated Loss - 100-year Flood				Residential and Commercial Combined (\$1,000)			
City	County Name	County FIPS	Residential Population	Building Count	Exposure	Losses	Percent Loss Ratio
Cape Girardeau	Cape Girardeau	29031	4,513	1,553	550,474	85,575	16%
Kansas City	Jackson	29095	14,296	4,582	1,729,696	167,021	10%
Springfield	Green	29007	5,620	1,759	540,231	36,318	7%
St. Louis*	St. Louis	29189	40,652	12,220	4,458,870	558,155	13%
St Louis City	St Louis City	29510	2,430	780	210,224	23,135	11%
St. Charles	St. Charles	29183	17,454	5,638	1,539,239	216,753	14%
Jefferson	Cole	29051	4,199	1,099	313,729	66,515	21%

Source: HAZUS-MH

\*Unincorporated

### 3.6 Estimating Potential Losses of State Facilities

**44 CFR 201.4(c)(2)(iii) – The risk assessment shall include the following: an overview and analysis of potential losses to identified vulnerable structures, based on estimates provided in the state risk assessment. The State shall estimate the potential dollar losses to State-owned or operated buildings, infrastructure, and critical facilities located in identified hazard areas.**

Quantitative or qualitative losses were estimated for State High Priority Facilities, based on available data for earthquake and tornado hazards. Flood losses were not analyzed because State High Priority Facilities appear to not be vulnerable to flood hazard (see section 3.3.2). **Table 47** depicts the estimated loss to State High Priority Facilities due to an earthquake with a 100-year and 500-year recurrence interval by agency and county

**Table 47. Estimated Loss to State High Priority Facilities due to Earthquake**

Acronym	County	Number of Facilities	Estimated Loss 100-year Earthquake	Estimated Loss 500-year Earthquake
AG	Cole	1	0	85,017
AG	Saint Louis	1	264,434	2,379,902
DHS	Cole	1	0	48,005
DMH	Adair	1	0	2,427,907
DMH	Butler	1	50,744	932,639
DMH	Callaway	1	0	1,305,094
DMH	Cape Girardeau	1	315,178	7,178,565
DMH	Cole	1	0	81,001
DMH	Gentry	1	0	21,437
DMH	Greene	1	0	22,806
DMH	Jackson	2	0	655,881
DMH	Jasper	1	0	678,687
DMH	Lafayette	1	0	263,209
DMH	Marion	1	0	24,519
DMH	Phelps	1	0	287,728
DMH	Saint Francois	1	573,922	5,124,291
DMH	Saint Louis	6	2,767,621	10,514,295
DMH	Saline	1	0	736,590
DMH	Scott	1	118,100	1,817,483
DMH	Vernon	1	0	665,113
DOC	Audrain	1	0	501,989
DOC	Buchanan	1	0	594,123
DOC	Cole	3	0	2,454,792
DOC	Cooper	1	0	929,783
DOC	Dakalb	2	0	1,180,956
DOC	Livingston	1	0	154,428
DOC	Pike	1	0	877,175
DOC	Randolph	1	0	963,964
DOC	Saint Francois	1	1,474,106	11,166,867

Acronym	County	Number of Facilities	Estimated Loss 100-year Earthquake	Estimated Loss 500-year Earthquake
DOC	Saint Louis	1	289,194	1,511,388
DOC	Washington	1	595,911	2,856,097
DOC	Webster	1	0	194,789
DOT	Buchanan	1	0	13,163
DOT	Cole	1	0	100,099
DOT	Greene	1	0	26,098
DOT	Howell	1	0	13,344
DOT	Jackson	1	0	26,098
DOT	Jasper	1	0	21,801
DOT	Marion	1	0	21,332
DOT	Saint Louis	1	23,696	118,481
DOT	Scott	1	39,488	539,663
DPS	Buchanan	1	0	20,652
DPS	Butler	1	16,952	135,619
DPS	Cole	7	0	263,570
DPS	Greene	1	0	20,150
DPS	Jackson	1	0	23,108
DPS	Macon	1	0	14,808
DPS	Saint Louis	1	25,644	51,288
GOV	Cole	1	0	66,096
MULT	Cole	1	0	938,618
STO	Jackson	1	0	271,879
<b>TOTAL</b>		<b>66</b>	<b>5,924,636</b>	<b>61,322,387</b>

**Table 48** shows the potential qualitative risk to tornado by county. The numbers of State High Priority Facilities are depicted as having a low, medium, or high risk to tornadoes by county.

**Table 48. Potential Qualitative Risk due to Tornado by County**

Acronym	County	Low	Medium	High	Total
AG	Cole	0	1	0	<b>1</b>
AG	Saint Louis	0	0	1	<b>1</b>
DHS	Cole	0	1	0	<b>1</b>
DMH	Adair	0	0	1	<b>1</b>
DMH	Butler	0	0	1	<b>1</b>
DMH	Callaway	0	1	0	<b>1</b>
DMH	Cape Girardeau	0	0	1	<b>1</b>
DMH	Cole	0	1	0	<b>1</b>
DMH	Gentry	0	0	1	<b>1</b>
DMH	Greene	0	1	0	<b>1</b>
DMH	Jackson	0	0	2	<b>2</b>
DMH	Jasper	0	0	1	<b>1</b>
DMH	Lafayette	0	1	0	<b>1</b>
DMH	Marion	0	0	1	<b>1</b>

Acronym	County	Low	Medium	High	Total
DMH	Phelps	0	1	0	1
DMH	Saint Francois	0	1	0	1
DMH	Saint Louis	0	0	6	6
DMH	Saline	0	1	0	1
DMH	Scott	0	0	1	1
DMH	Vernon	0	0	1	1
DOC	Audrain	0	1	0	1
DOC	Buchanan	0	0	1	1
DOC	Cole	0	3	0	3
DOC	Cooper	0	1	0	1
DOC	Dakalb	0	0	2	2
DOC	Livingston	0	1	0	1
DOC	Pike	0	0	1	1
DOC	Randolph	0	1	0	1
DOC	Saint Francois	0	1	0	1
DOC	Saint Louis	0	0	1	1
DOC	Washington	0	1	0	1
DOC	Webster	0	1	0	1
DOT	Buchanan	0	0	1	1
DOT	Cole	0	1	0	1
DOT	Greene	0	1	0	1
DOT	Howell	0	1	0	1
DOT	Jackson	0	0	1	1
DOT	Jasper	0	0	1	1
DOT	Marion	0	0	1	1
DOT	Saint Louis	0	0	1	1
DOT	Scott	0	0	1	1
DPS	Buchanan	0	0	1	1
DPS	Butler	0	0	1	1
DPS	Cole	0	7	0	7
DPS	Greene	0	1	0	1
DPS	Jackson	0	0	1	1
DPS	Macon	0	1	0	1
DPS	Saint Louis	0	0	1	1
GOV	Cole	0	1	0	1
MULT	Cole	0	1	0	1
STO	Jackson	0	0	1	1
<b>TOTAL</b>		<b>0</b>	<b>33</b>	<b>33</b>	<b>66</b>

## Conclusions

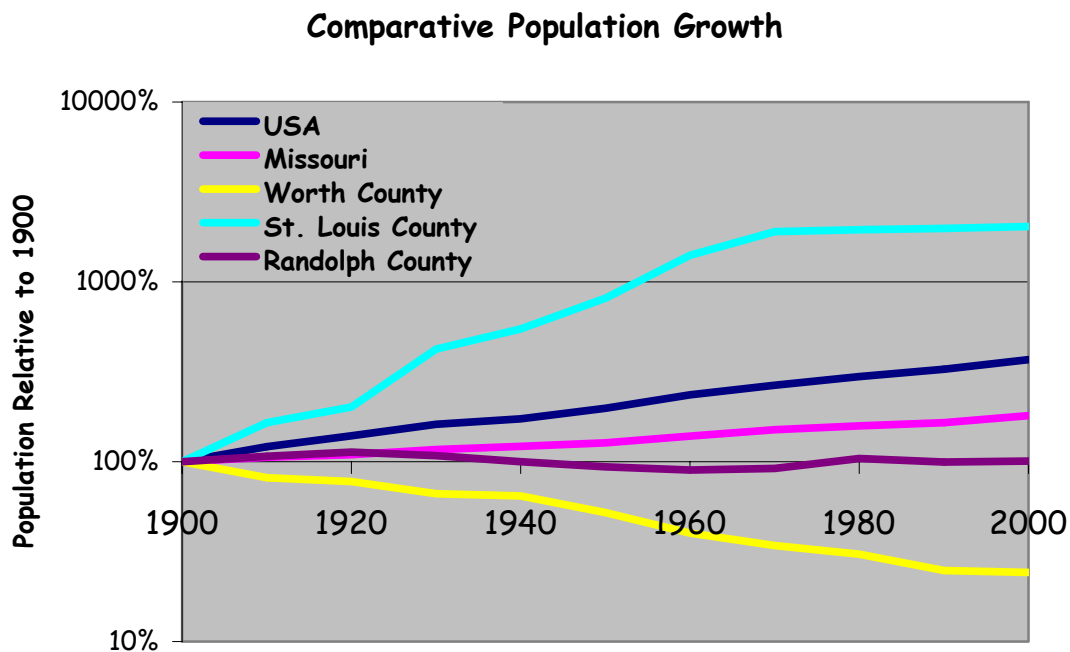
The results of this analysis are useful in at least three ways:

1. Improving our understanding of the risk associated with the natural hazards in the State of Missouri through better understanding of the complexities and dynamics of risk, how levels of risk can be measured and compared, and the myriad factors that influence risk. An understanding of these relationships is critical in balanced and informed decisions on managing the risk.
2. Providing a baseline for policy development and comparison of mitigation alternatives. The data used for this analysis present a current picture of risk in the State of Missouri. Updating this risk “snapshot” with future data will enable comparison of the changes in risk with time. Baselines of this type can support the objective analysis of policy and program options for risk reduction in the region. **Figure 77** below, a snapshot of the future growth in the State of Missouri, underlines that the current risk will only increase if no risk reduction measures are planned and implemented.
3. Comparing the risk among the natural hazards addressed. The ability to quantify the risk to all these hazards relative to one another helps in a balanced, multi-hazard approach to risk management at each level of governing authority. This risk analysis provides a systematic framework to compare and prioritize the very disparate natural hazards that are present in the State of Missouri. This risk assessment provides the necessary information for the Mitigation Planning Committee to craft a mitigation strategy to focus resources on only those hazards that pose the most threat to the State.

Note: The state, where appropriate, will incorporate locally developed data to enhance future risk assessment updates.



**Figure 77. Expected Population Growth Versus Time in Missouri**



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## **4.0 COMPREHENSIVE STATE HAZARD MITIGATION PROGRAM**

### **Introduction**

It is essential that State and local mitigation policy be directed to minimize the risk of future devastation and the corresponding impact on the citizens of the State of Missouri. This can only be accomplished by establishing workable goals and objectives that integrate the efforts of state and local governments into one cohesive mitigation strategy that also take full advantage of public-private partnerships.

Development of a sound mitigation strategy provides a focus that assists State and local governments to identify priorities and channel their limited resources towards critical mitigation projects. This process helps government at all levels make the most effective use of available resources.

The State of Missouri will enhance its ability to complete its goals and objectives by taking maximum advantage of the mitigation resources available, both present and future, to reduce the impact of natural and human caused disasters on the citizens and infrastructure of the State of Missouri. The State will also vigorously pursue methods to augment existing state and local programs by involving other opportunities, such as public-private partnerships.

The State will provide education and training on the benefits of a comprehensive statewide hazard mitigation program for state agencies, local governments, private enterprises, and the citizens of the State of Missouri will remain a priority.

### **4.1 Goals, Objectives and Activities**

**Requirement 44 CFR §201.4(c)(3) (i): The mitigation strategy shall include a description of State goals to guide the selection of activities to mitigate and reduce potential losses.**

The purpose of this section is to describe the general goals and objectives of the State mitigation program. In order to be effective, these goals and objectives must be achievable, while at the same time complimenting both the State and local mitigation strategy. Before adopting them, the State of Missouri evaluated the goals, objectives and especially the mitigation measures (actions) using the Social, Technical, Administrative, Political, Legal, Economic and Environmental (STAPLEE) criterion. It is important that state and local government, public-private partnerships, and the average citizen can see the results of these mitigation efforts. By establishing achievable goals and objectives the various groups involved in the process can see that their efforts are making a difference and involvement in other mitigation efforts can be achieved.

As local plans are submitted for review and approval, the risk assessment outlined in this plan will be updated accordingly. As part of that process, the goals and objectives outlined in this plan will also be reviewed and updated as needed to reflect the current situation in the State. Every mitigation project that is considered for review and approval should, at the very minimum, have as its final result the potential to reduce the affects of a future disaster event.

The following list provides the primary goals and objectives for the State's hazard mitigation program in prioritized order. The goals and objectives reflect the mature nature of SEMA's ongoing Statewide Hazard Mitigation Program. SEMA's partners are encouraged to consider these mitigation goals when developing mitigation and other plans.

## **The State of Missouri's Goals and Objectives for Disaster Mitigation are:**

### **Goal 1: Implement mitigation actions that improve the protection of human life, health, and safety from the adverse effects of disasters.**

Objective 1. Maintain a robust mitigation program that addresses ways to mitigate the loss of life from disaster events. (To include supporting the development and funding of sensible mitigation projects to reduce future flooding, eliminating repetitive flood losses, improving safety and reducing losses during severe weather events, mitigating losses due to earthquake, minimizing losses due to terrorism, and reducing risk and losses due to drought, high heat, and fire.)

Objective 2. Strengthen cooperation with SEMA's mitigation partners and help educate them about mitigation.

Objective 3. Support the development of sensible enabling legislation, programs and capabilities of federal, state, and local governments and public-private partnerships engaged in mitigation activities.

Objective 4. Increase public awareness of disaster risks and effective mitigation measures that protect life.

Objective 5. Maintain a high level of mitigation proficiency within the SEMA staff.

### **Goal 2: Implement mitigation actions that improve the protection of continuity of government and essential services safety from the adverse effects of disasters.**

Objective 1. Support the development of sensible mitigation projects to protect key and essential facilities and services.

Objective 2. Continue to educate federal, state, and local public officials, educational institutions, private associations and private business entities that provide essential services about disaster hazards and how mitigation can reduce losses and help maintain continuity.

Objective 3. Educate state and local officials concerning the need to use sensible mitigation techniques for new facility construction.

Objective 4. Encourage maximum participation in maintaining effective state and local mitigation plans, disaster plans and business continuity plans.

Objective 5. Encourage federal, state and local officials, educational institutions, private associations and private business entities that provide essential services to incorporate mitigation into other plans.

**Goal 3: Implement mitigation actions that improve the protection of public and private property from the adverse effects of disasters.**

Objective 1. Maintain a robust mitigation program that addresses ways to mitigate the loss of property from disaster events. (To include supporting the development and funding of sensible mitigation projects to reduce future flooding, eliminating repetitive flood losses, improving safety and reducing losses during severe weather events, mitigating losses due to earthquake, minimizing losses due to terrorism, and reducing risk and losses due to drought, high heat, and fire.)

Objective 2. Strengthen cooperation with SEMA's mitigation partners and help educate them about mitigating the loss of property.

Objective 3. Support organizations that work to help mitigate the adverse effects of disasters.

Objective 4. Increase public awareness of disaster risks and effective mitigation measures that protect property.

Objective 5. Support the NFIP, CRS, earthquake insurance, and other programs that serve to lessen the adverse impact of disaster property losses.

**Goal 4: Implement mitigation actions that improve the protection of community tranquility from the adverse effects of disasters.**

Objective 1. Develop, implement and complete mitigation projects as expeditiously, effectively, efficiently and unobtrusively as possible.

Objective 2. Consider Sustainability issues (ecologically sound, economically viable, socially just & humane) when developing or reviewing mitigation projects and plans.

Objective 3. Lead and support the work of mitigation partners to educate the general public about how mitigation can help protect communities and promote community tranquility.

Objective 4. Develop and provide periodic reports and success stories to federal, state, and local public officials, educational institutions, private associations, private business entities and the public on the progress of hazard mitigation activities.

Objective 5. Encourage citizens and citizen organizations to support and use mitigation in plans, projects and public outreach to increase a sense of community security and safety. These goals and objectives will be reviewed as part of the regular plan review process. They will also be reviewed in conjunction with the review/approval process of local hazard mitigation plans. This will help ensure that State and local hazard mitigation plans complement each other and that both State and local governments are working together to accomplish the mitigation goals of the State of Missouri. Additionally, proposed mitigation projects will be reviewed to determine how mitigation projects help state and local governments meet established goals and objectives.

### **Actions (Projects) that will be considered by the State of Missouri**

There are a number of actions or projects that SEMA has identified that, if proven cost-effective, comply with all the federal and state requirements for mitigation funding and fulfill this plan's identified goals and objectives. The actions listed below are the primary ones SEMA supports for addressing the hazards analyzed in this plan. These actions or projects, including the manner in which they are prioritized, are explained in detail in the enhanced portion of this plan.

M 1 - State and Local Hazard Mitigation Plans (Required to qualify for mitigation funding)

M 2 - NFIP Floodplain Management & Community Rating System

M 3 - Voluntary Property Acquisitions (Flood Buyout)

M 4 - Voluntary Elevation, Relocation, Floodproofing

M 5 – Structural/Infrastructure Mitigation Projects (Including Public Assistance Projects)

M 6 - Tornado Safe Rooms

M 7 - Buried Electric Service Lines

M 8 - Earthquake/High Wind Structural Mitigation Projects

M 9 - Earthquake/High Wind Non-Structural Mitigation Projects

M10- State 5% Initiative Projects

Goals/Objectives	M 1	M 2	M 3	M 4	M 5	M 6	M 7	M 8	M 9	M10
<b>Goal 1</b>										
Objective 1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Objective 2	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Objective 3	✓	✓				✓		✓	✓	✓
Objective 4	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Objective 5	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
<b>Goal 2</b>										
Objective 1	✓	✓			✓	✓	✓	✓	✓	✓
Objective 2	✓	✓			✓	✓	✓	✓	✓	✓
Objective 3	✓	✓			✓	✓	✓	✓	✓	✓
Objective 4	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Objective 5	✓	✓			✓	✓	✓	✓	✓	✓
<b>Goal 3</b>										
Objective 1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Objective 2	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Objective 3	✓	✓				✓		✓	✓	✓

Goals/Objectives	M 1	M 2	M 3	M 4	M 5	M 6	M 7	M 8	M 9	M10
Objective 4	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Objective 5	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
<b>Goal 4</b>										
Objective 1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Objective 2	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Objective 3	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Objective 4	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Objective 5	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

**Data Limitation Note:** Once local mitigation plans currently under development are approved, SEMA will incorporate the knowledge and analysis obtained through those plans into future updates of the State Hazard Mitigation Plan per M1 above.

In addition, SEMA over the years has partnered in and/or supported many of the efforts of other State and Federal Agency and Department partners, businesses, educational institutions and private associations in programs and activities that serve to help mitigate damages in disasters. A few examples include, but are not limited to:

NRCS Flood Detention/Retention Basin Projects, Stormwater Management Programs, River & Creek Cleanup, Streambank Stabilization, Dam Safety, Wetlands Protection, Reduction of Environmental Damage, Historical Areas & Property Documentations, U.S. Fish & Wildlife Protection of Endangered Species & Wildlife, ASFPM Education Programs, Corps of Engineers Flood Control Programs, Dam Safety, NOAA Weather Warning Radios, NWS/NOAA StormReady Program, Placing Utilities Underground, Automatic Shutoff Valves (gas & water) Building Codes, Bridge & Highway Retrofits & Building to Seismic Design, USGS Soil Mapping & Seismic Studies, Central U.S. Earthquake Consortium (programs, studies, outreach, task forces, working groups), SAVE Coalition Post-& Pre-Disaster Inspection ATC-20 & 21 Training Programs, Disaster Healthcare Programs, Sanitation & Disease Prevention, USDA Rural Development Community Safety Programs, Soil Conservation & Stabilization, Multiple Disciplines of Planning, American Red Cross Mitigation Committee, Volunteer Programs, Homeland Security Programs, Business Continuity Planning, and Disaster Education in Schools, including Disaster Resistant Universities.

## 4.2 State Capability Assessment

**Requirement §201.4(c)(3) (ii):** The State mitigation strategy shall include a discussion of the State's pre-and post-disaster hazard management policies, programs, and capabilities to mitigate the hazards in the area, including:

*An evaluation of State laws, regulations, policies, and programs related to hazard mitigation as well as to development in hazard-prone areas; [and]*

*A discussion of State funding capabilities for hazard mitigation projects.*

### 4.2.1 State Programs

While each state agency administers its own programs, SEMA serves as the focal point for the overall State mitigation strategy. The entity with primary responsibility for state review of mitigation initiatives is the State Hazard Mitigation Project Coordination Group. SEMA is the lead agency within this group for mitigation issues. All State agencies work together to ensure



that the various mitigation programs compliment each other and contribute towards the State's overall mitigation strategy.

### **State Emergency Management Agency (SEMA)**

The State Emergency Management Agency (SEMA) is governed by Chapter 44, RSMo. The SEMA Director is the State Coordination Officer (SCO) during disasters and also serves as the Governor's Authorized Representative (GAR) representative and liaison with FEMA, which supplies the Federal Coordinating Officer. During disaster operations, all departments of state government are expected to cooperate fully with requests from the SEMA director for assistance. The Governor's declaration of a state emergency initiates the operation of the State Emergency Operations Plan (SEOP), which is continually updated by SEMA to meet changing conditions.

SEMA is the State agency responsible for coordinating statewide emergency preparedness, response, recovery, and mitigation activities among federal, state and local agencies. SEMA is the primary State agency for funding, administering, and coordinating numerous hazard mitigation grant programs and mitigation projects. Under the supervision of the State Hazard Mitigation Officer, SEMA's Mitigation Management Section administers the Earthquake Program, Hazard Mitigation Grant Programs (HMGP), Pre-Disaster Mitigation Programs, Disaster Resistant University (DRU) Program and Flood Mitigation Assistance (FMA) Programs that make up the State Mitigation Program for various mitigation projects for flooding, severe weather and other natural hazards. The Section also is responsible for the development of the State Hazard Mitigation Plan, and working with businesses, institutions of education, private associations, local governments, and the 19 Regional Planning Commissions (RPCs) of the Missouri Association of Councils of Governments (MACOG) to prepare local Hazard Mitigation Plans statewide. In addition, the Section's Earthquake Program Manager is responsible for overseeing the Earthquake Program and its various organizations and activities such as the Missouri State Seismic Safety Commission and the more than 1,150 volunteer inspector members of the SAVE Coalition.

SEMA also has responsibility for the State Floodplain Management Program. The Floodplain Management Section is responsible for issuing floodplain management permits for all State agencies.

In addition, the Missouri Emergency Response Commission (MERC) is a part of SEMA. Having knowledge of where chemicals are stored and training first responders reduces the possibility of and effects of disasters. The MERC's duties include, but are not limited to:

- Develop and test hazardous duty response plan;

- Provide training for first responders;

- Review local chemical response plans; and

- File and maintain over 10,000 hazardous chemical inventory reports.

Many other agencies are involved in statewide emergency preparedness, response, recovery, and mitigation activities.

**Attorney General's Office**

The Attorney General's Office represents the legal interests of the State of Missouri and its state agencies.

**Department of Public Safety**

The Department of Public Safety provides legal counsel to the State Emergency Management Agency for mitigation and other emergency management related issues, as needed.

**Missouri Office of Administration (OA)**

The Missouri Office of Administration (OA) enforces floodplain management regulations for State facilities. Within OA, the Division of Design and Construction manages the state's facilities program. It selects consulting architectural and engineering firms for capital improvements projects, administers the construction program, and assist agencies in preparing their capital improvement budget requests.

**Missouri Department of Economic Development**

The Missouri Department of Economic Development administers the Community Development Block Grant (CDBG) program funds and administers various mitigation projects, including the acquisition of flood-prone homes and businesses, throughout the State. This department also administers programs for State "distressed" and "targeted" communities.

**Missouri Department of Conservation (DOC)**

The Missouri Department of Conservation (DOC) owns many undeveloped floodplain areas that provide floodway during high flows. It is also a member of numerous levee districts, which offer flood protection to crops and structures. All DOC lakes with dams over 35 feet high are designed in accordance with the State "dam safety commission" criteria. The safety or redundancy factor built into DOC dam and levee construction projects is much higher than for normal commercially constructed projects. In addition, DOC facilities for launching and landing boats flood regularly. Such structures are designed to be "low profile" in nature and, therefore, relatively flood proof.

The Missouri Department of Conservation also participates in a statewide wildfire control program in cooperation with the forest industry, rural fire departments and other agencies. Prescribed burning of prairies, glades, savannas, etc., may increase the risks of fire hazards; however, prescribed burning reduces the availability of fire fuels and therefore the potential for future, more serious fires.

**Missouri Department of Highway and Transportation (MoDOT)**

The Missouri Department of Highway and Transportation (MoDOT) personnel provide technical assistance to the various emergency management programs, to include mitigation. This assistance is addressed in the SEMA-MoDOT Memorandum of Agreement and includes, but is not limited to:

Environmental reviews;

Archaeological surveys; and

Historic preservation reviews.

In addition, MoDOT and SEMA coordinate buyout projects to ensure that there are no potential right-of-way conflicts with future use of land for bridge and highway projects, and collaborate on earthquake mitigation.

#### **Missouri Department of Natural Resources (DNR)**

The Missouri Department of Natural Resources (DNR) administers various projects designed to reduce stream bank erosion, reduce localized flooding, improve drainage, and improve discharge water quality through the storm water grant program funds. Within DNR, the Division of Geology and Land Survey is responsible for the use and development of Missouri's mineral, land and water resources, and collaboration on earthquake mitigation. The division also houses the State's land survey records and works to ensure that Missouri's dams meet adequate safety requirements.

### **4.2.2 Pre & Post Disaster Legislation/Regulations**

There are currently no State laws, codes, or regulations that specifically address the topic of hazard mitigation. With a few exceptions, the counties and cities of Missouri have generally been against the establishment of any kind of codes and standards. This has been a difficult hurdle to overcome and has forced state mitigation staff to pursue all possible avenues to demonstrate the effectiveness of cost-effective mitigation initiatives.

Some of the successes and initiatives being undertaken by the state mitigation program are as follows:

There are several State statutes that address the issue of seismic construction and renovation ordinances for those areas of the State that are subject to the earthquake threat.

In July of 1997, Executive Order 97-09 was signed by the Lieutenant Governor authorizing the Missouri State Emergency Management Agency (SEMA) to issue floodplain development permits for any state owned or leased development in a special flood hazard area. Over the last five years, there has been an explosive effort by state floodplain management staff to bring heightened awareness and technical assistance to local communities. Training, joint seminars with the Flood Insurance Administration, and an annual workshop have been institutionalized. A local guidebook and a quick reference manual have recently been released and hailed a success by local communities and FEMA.

Jurisdictions that participate in the National Flood Insurance Program (NFIP) have established ordinances related to floodplain development. The SEMA floodplain management section provides guidance and sample ordinances to communities interested in developing local floodplain programs.

There are also policies, procedures, and/or plans within each applicable State agency/department that address the requirements and administration of the various mitigation programs within them. There are several sections in the Revised Statutes of Missouri (RSMo) that address the issues of dam safety, earthquake safety, and emergency systems.

*Ref. RSMo 256.173.1:* The Division of Geology and Land Survey within the Missouri Department of Natural Resources shall provide each county and city not within a county, as the information becomes available, a geologic hazard assessment.

*Ref. RSMo 256.173.2:* The Missouri Department of Natural Resources shall provide each recorder of deeds of each county in the State a map showing the downstream area that would be affected in the event of a dam failure.

*Ref. RSMo 256.175.2:* The Missouri Department of Natural Resources shall be designated as the lead technical agency in the State to conduct studies concerning the geologic effects of earthquakes.

*Ref. RSMo 319.200.1:* Each city, town, village, or county which can be expected to experience an intensity of ground shaking equivalent to a Modified Mercalli of VII or above from an earthquake occurring along the New Madrid Fault with a potential magnitude of 7.6 on the Richter Scale, shall adopt an ordinance or order requiring that new construction, additions and alterations comply with the standards for seismic design and construction of the building officials and code administrators code or of the uniform building code.

*Ref. RSMo 160.451:* The governing body of each school district which can be expected to experience an intensity of ground shaking equivalent to a Modified Mercalli of VII or above from an earthquake occurring along the New Madrid Fault with a potential magnitude of 7.6 on the Richter Scale shall establish an earthquake emergency procedure system in every school building under its jurisdiction.

*Ref. RSMo 160.453.1:* This earthquake emergency system shall include, but not be limited to:

A school building disaster plan;

An emergency exercise to be held at least twice each school year;

Protective measures to be taken before, during, and following an earthquake; and

A program to ensure that the students and certified and noncertified employees of the school district are aware of, and properly trained in, the earthquake emergency procedure system.

At the beginning of each school year, each school district shall distribute to each student materials that address the areas of earthquake hazards and safety.

State laws, regulations, policies, and programs related to hazard mitigation as well as to development in hazard-prone areas are adequate for Missouri's ongoing hazard mitigation programs as far as the political situation will allow for the foreseeable future.

### **4.3 Local Capability Assessment**

**Requirement 44 CFR §201.4(c)(3) (ii): The mitigation strategy shall include a general description and analysis of the effectiveness of local mitigation policies, programs, and capabilities.**

SEMA has also been actively working with local governments throughout the State to generate interest and develop initiatives for hazard mitigation. The focus of this initiative is to generate interest at the local level and create advocates for the program. This work has taken place through the following forums:

SEMA mitigation staff schedule and conduct Mitigation for Emergency Managers workshops to educate local emergency managers on the various mitigation programs and initiatives that are available and the benefits of those programs. These workshops provide an opportunity for an exchange of ideas and the development of mitigation initiatives based on the evaluation of state and local needs. Additionally, it helps generate interest in the mitigation program from the ground up.

The SEMA/MEPA Spring Conference is an annual event and includes workshops on a variety of subjects. One of those workshops addresses the mitigation program. Topics have included the mitigation planning process, risk assessment, identification and development of viable mitigation projects, cost benefit analysis, and public-private partnerships. Attendees include federal, state, and local emergency management officials, state and local elected representatives, business and industry representatives, and volunteer organizations.

SEMA publishes a quarterly newsletter that is used to address issues of concern related to all aspects of emergency management, to include hazard mitigation. This newsletter is sent to emergency management officials, state and local elected officials. SEMA also distributes an EMD Bulletin twice a month. This bulletin provides an opportunity for SEMA to address issues that may arise between the distribution of issues of the Quarterly Newsletter. The bulletin is sent to local emergency managers. The newsletter and the bulletin have been used to explain mitigation planning requirements, solicit ideas/initiatives, highlight community mitigation success stories, and explain federal/state mitigation requirements.

The State mitigation program is making a concerted effort to spread the word on the short and long-term benefits of well-planned, comprehensive mitigation initiatives. This is done through the use of newsletters, training workshops, conferences, success stories, etc. While the formal adoption of codes and standards may not be possible for some jurisdictions, efforts are being made to strongly encourage local government, businesses, and individuals to voluntarily adopt building practices and land use planning that take mitigation measures into consideration. By demonstrating the long term benefits of these measures to the community at large we are seeing more of these initiatives take hold. Many jurisdictions are getting involved in various on-going planning activities related to community growth. Some of these include:

**Land Use Planning.** Local governments are using land use planning to identify areas subject to damage from natural hazards and are working to keep inappropriate development out of those areas. Counties and cities are starting to work together in some areas to coordinate land use issues so that one jurisdiction does not adversely affect the other.

**Subdivision Regulations.** Jurisdictions are starting to look at the impacts of existing and planned subdivision developments and methods to reduce and/or eliminate those impacts. Combinations of storm water retention projects and locally funded buyouts are making a significant difference in this area.

**Capital Improvement Planning.** More and more jurisdictions are taking cost-effective mitigation measures into consideration when developing capital improvement projects. Success stories continue to show that development, with associated mitigation measures, can take place with minimal natural hazard risk. The dissemination of these success stories will continue to strengthen the overall mitigation program at both the state and local levels.

Data Limitation Note: SEMA's knowledge of and ability to analyze local policies, programs and capabilities will continue to improve through the local mitigation plans currently being developed. SEMA will incorporate that improved knowledge and analysis in future updates of the State Hazard Mitigation Plan as local plans are approved.

## **4.4 Mitigation Measures**

**Requirement 44 CFR §201.4(c)(3) (iii): The plan shall include an identification, evaluation, and prioritization of cost-effective, environmentally sound, and technically feasible mitigation actions and activities the State is considering and an explanation of how each activity contributes to the overall mitigation strategy. This section should be linked to local plans, where specific local actions and projects are identified.**

This section of the State Hazard Mitigation Plan addresses the issue of identification and evaluation of cost-effective and technically feasible hazard mitigation projects and initiatives. All hazard mitigation projects within the State are designed to mitigate the affects of disasters on one or more of the following:

Life safety of the at-risk population;

National Flood Insurance Program (NFIP) repetitive loss properties;

Private structures and properties;

Government facilities;

Public infrastructure (through Section 404 HMGP program funds);

Environmental resources;

Functionality of critical facilities; and

Public facilities and infrastructure damaged by a disaster that can be mitigated through FEMA's Public Assistance program funding.

The process used to identify cost-effective and technically feasible mitigation projects/actions will be based, primarily, on the source of the mitigation funds.

### **4.4.1 Disaster Funds**

Mitigation funds that are available as a result of a presidentially declared disaster are based on a percentage of the overall federal share of disaster assistance provided as a result of that disaster. Mitigation funds can be used anywhere in the State and on any hazard, however, priority will be given to:

1. Mitigation projects related to the hazard that necessitated the disaster declaration; and
2. Those jurisdictions included in the disaster declaration.

SEMA hazard mitigation staff will work with FEMA mitigation staff to determine the approximate amount of hazard mitigation funds available to the State. Then, State officials will determine the specific hazard mitigation issues to be addressed with projected mitigation funds, and SEMA will notify all potential applicants of the availability of mitigation funds and request the submission of proposed mitigation projects.

SEMA mitigation staff will review these proposals for the following criteria:

1. Does the project compliment existing State and local mitigation goals and objectives?
2. Is the project cost-effective, based on applying the submitted project data to FEMA's benefit cost analysis module?
3. Are sufficient mitigation funds available to complete the project?
4. Does the applicant have sufficient funds (if other funds are not available) to meet the local share of the project?
5. Does the project solve a problem?
6. Is the applicant located within the declared areas for the applicable disaster? (This does not prevent a mitigation project from being approved.)

If necessary, SEMA mitigation staff may coordinate, in conjunction with FEMA and the applicant, with other State and/or federal agencies to ensure that the project complies with all State and/or federal laws and regulations. These requirements include, but are not limited to, the Endangered Species Act, the Historic Preservation Act, Floodplain Management and National Environmental Policy Act requirements.

SEMA mitigation staff will forward the final mitigation project package to FEMA Region VII mitigation staff for final approval.

### **Federal Unmet Needs Programs**

Mitigation funds associated with a federal unmet needs program are generally available only if the U.S. Congress directs funding towards the program. These mitigation funds can only be used in those jurisdictions identified for the applicable unmet needs allocation. These jurisdictions are generally associated with specific presidential disaster declarations. The State's flexibility in identifying potential mitigation projects is somewhat limited because the unmet needs funding allocation will usually specify the types of mitigation projects that can be funded with unmet needs money.

SEMA hazard mitigation staff will work with FEMA mitigation staff to determine the approximate amount of unmet needs hazard mitigation funds available to the State. State officials will determine the specific hazard mitigation issues to be addressed with projected mitigation funds. SEMA will notify all potential applicants of the availability of unmet needs mitigation funds and request the submission of proposed mitigation projects.

SEMA mitigation staff will review these proposals for the following criteria:

1. Does the project compliment existing State and local mitigation goals and objectives?
2. Is the project cost-effective, based on applying the submitted project data to FEMA's benefit cost analysis module?
3. Are sufficient mitigation funds available to complete the project?

4. Does the applicant have sufficient funds (if other funds are not available) to meet the local share of the project?
5. Does the project solve a problem?
6. Is the applicant located within the areas designated by the unmet needs funds allocation?

If necessary, SEMA mitigation staff may coordinate, in conjunction with FEMA and the applicant, with other State and/or federal agencies to ensure that the project complies with all State and/or federal laws and regulations. These requirements include, but are not limited to, Endangered Species Act, Historic Preservation Act, Floodplain Management and National Environmental Policy Act requirements.

SEMA mitigation staff will forward the final mitigation project package to FEMA Region VII mitigation staff for final approval.

The FY 2003 budget provided \$150 million to initiate a new competitive Pre-Disaster Mitigation (PDM) Grant Program for State, Tribal and local government mitigation planning activities and projects. The new competitive program is intended to provide technical and financial assistance to states and local governments to assist in the implementation of pre-disaster hazard-mitigation measures that are cost-effective and that are designed to reduce injuries, loss of life, and damage and destruction of property, including damage to critical services and facilities under the jurisdiction of the states or local governments and to create an interagency task force to address pre-disaster mitigation. Eligible entities were required to provide a 25 percent non-federal match for these grants, with small, impoverished communities eligible for a 10 percent non-federal match. About \$13.5 million was set aside for planning purposes and \$3.6 million for a Disaster Resistant University program. A cap of \$3 million was established for mitigation projects. Up to 10 percent may be used for information dissemination activities related to the project. Management costs are capped at 10 percent. SEMA mitigation staff will review proposals for the following criteria:

1. Does the project compliment existing State and local mitigation goals and objectives?
2. Is the project cost-effective, based on applying the submitted project data to FEMA's benefit cost analysis module?
3. Are sufficient mitigation funds available to complete the project?
4. Does the applicant have sufficient funds (if other funds are not available) to meet the local share of the project?
5. Does the project solve a problem?

#### **4.4.2 Other Mitigation Programs**

The availability of mitigation funds associated with other federal/state programs is dependent on the specific program in question. These mitigation funds can only be used in those jurisdictions identified by the applicable program. Since these funds are generally available based on applications submitted by specific jurisdictions, only those applying jurisdictions will have access to the funds.



The State's flexibility in identifying potential mitigation projects is somewhat limited because of the particular requirements associated with each program. We would encourage every jurisdiction that submits mitigation projects do so in such a manner that the project compliments current State and local hazard mitigation goals and objectives. Local officials will usually determine the specific hazard mitigation issues to be addressed with projected mitigation funds.

Since these programs are usually initiated between the jurisdiction and the applicable program staff, SEMA mitigation staff will review local mitigation proposals only upon request and if personnel are available. If that review is requested, SEMA mitigation staff will review the project based on the same criteria used for disaster related mitigation projects. Those criteria are as follows:

1. Does the project compliment existing State and local mitigation goals and objectives?
2. Is the project cost-effective based on applying the submitted project data to FEMA's benefit cost analysis module?
3. Are sufficient mitigation funds available to complete the project?
4. Does the applicant have sufficient funds (if other funds are not available) to meet the local share of the project?
5. Does the project solve a problem?

SEMA mitigation staff will advise the jurisdiction to coordinate with other State and/or federal agencies to ensure that the project complies with all State and/or federal laws and regulations. These requirements include, but are not limited to, the Endangered Species Act, the Historic Preservation Act, Floodplain Management and National Environmental Policy Act requirements.

SEMA mitigation staff will forward their comments to the jurisdiction for their final review and determination.

When evaluating mitigation projects that have been submitted for review and possible approval, several factors must be taken into consideration. These factors include, but are not limited to, the following:

1. The specific requirements and/or restrictions placed on the projects by the funding source.
2. There will always be more requests for mitigation funds than there will be available funds.
3. Federal and State funding for mitigation projects will be limited and in some instances may not be available.
4. Whenever possible, local jurisdictions should develop mitigation projects and initiatives that can be funded locally.
5. Local jurisdictions should actively pursue public-private partnerships, where appropriate, to achieve desired mitigation goals.
6. The requested mitigation project should compliment the goals and objectives of the State and local mitigation strategy.

### **4.4.3 Mitigation Success**

The ultimate goal of the State mitigation program is to encourage and motivate State and local government agencies, as well as the public and private sectors, to mitigate against the effects of the natural hazards affecting them, and to establish priorities for hazard mitigation programs in all areas of the State. To accomplish these goals, members of the Hazard Mitigation Project Coordinating Group reviewed existing State statutes, on-going mitigation initiatives, proposed mitigation initiatives/projects, and completed mitigation projects. The review of completed mitigation projects was directed primarily towards the project's overall success and contribution towards the goals and objectives of the State and local mitigation program.

Those programs that were deemed the most successful and/or beneficial to the overall mitigation program were:

The flood buyout program, which included the acquisition of over 4,500 flood-prone primary residences. This voluntary program removes families and residences from flood hazard areas with the corresponding benefits in life-safety issues and disaster related costs.

The NOAA weather radio project, which has shown an increase from ten (10) to thirty-one (31) NOAA weather warning transmitters in the State of Missouri. This now provides almost complete coverage of the State for this vital warning system. This success story is a result of the cooperative efforts of State, federal and local government, private citizens, business and industry, and the State's electric cooperatives.

The Local Mitigation Planning project, which was established to develop local hazard mitigation plans which will meet the requirements of the Disaster Mitigation Act of 2000. This project involves the use of the 7% planning funds available as part of the Hazard Mitigation Grant Program funds from two disasters from 2002 (MO-DR-1403 and MO-DR-1412). This project involves Regional Planning Commissions (RPCs) and Councils of Government (COGs) throughout the State, local communities, business and industry, and concerned private citizens in the mitigation planning process.

The National Flood Insurance Program initiatives, which has shown remarkable progress. When SEMA took responsibility for administration of the State's floodplain management program in 1995 there were 523 jurisdictions in the National Flood Insurance Program. Currently, there are 570 jurisdictions in the program. Additionally, there are currently 130 jurisdictions involved in floodplain mapping projects.

All of the projects/programs mentioned above are described in greater detail in this and other sections of this State Hazard Mitigation Plan. Due to the success of these programs, they will continue to be a priority for funding with available mitigation funds.

The State, through the State Emergency Management Agency (SEMA), has instituted an effective and comprehensive all-hazard mitigation program. Through the wise use of available federal and state funds, made available through a variety of programs (Section 404 Hazard Mitigation Grant Program (HMGP), Public Assistance Mitigation, Unmet Needs, Project Impact, Pre-Disaster Mitigation, State Community Development Block Grants (CDBG), State Department of Natural Resources Stormwater Grants, Natural Resources Conservation Service

(NRCS), etc. the State has been able to successfully mitigate many areas against the devastating effects of future disasters.

Missouri has developed a Local Officials Hazard Mitigation Planning guidebook and continually offers assistance to any community desiring to develop a plan. Hazard mitigation planning is a component of the state's disaster resistant community effort.

History and the recent Memorandum of Agreement with the Missouri Department of Transportation (MODOT) are telling indicators of the commitment of SEMA to be able to prepare environmental documentation and conduct benefit-cost analyses. Historically, SEMA has performed all cost-benefit analyses within the last three to four years for all hazard mitigation grant applications. All current mitigation staff members have received formal FEMA cost-benefit training and apply the software modules on a consistent basis to alleviate lapses in using the programs.

During the 1993 Mid-West floods, an Interagency Hazard Mitigation Team (IHMT) was formed. This team was composed of representatives from FEMA, SEMA, and various State agencies/departments (Governor's Office, Department of Economic Development (DED), Department of Natural Resources (DNR), Department of Transportation (MODOT, and others). The 1993, 1994, and 1995 buyout projects were selected, coordinated, and managed by a small committee appointed by the Governor for this specific purpose. The wisdom in this approach can be found in the results. Only six (6) months after hazard mitigation funding became available, all projects were approved.

This IHMT would later become the Hazard Mitigation Project Coordinating Group (HMPCG). While the name of this entity changed, the function of the group remains the same. Currently, hazard mitigation projects are coordinated through the Hazard Mitigation Project Coordinating Group. This coordination is primarily with representatives from the Missouri Department of Economic Development Community Development Block Grant (CDBG) Section, the Missouri Department of Transportation, the Missouri Department of Natural Resources Historic Preservation Section, and the U.S. Army Corps of Engineers (USACE). Other State and federal agencies may be added to this group as the situation and mitigation issue dictates. This practice will continue as hazard mitigation opportunities and initiatives are presented.

The mitigation process and the State's mitigation initiatives are ongoing. The SEMA mitigation staff, in conjunction with other State and local agencies, will continue to look for new opportunities and fund sources to expand existing mitigation initiatives and develop new ones. The primary focus for the use of disaster related Hazard Mitigation Grant Program (HMGP) funds has been the flood buyout program.

Since the 1993 floods, over 4,500 primary residences have been acquired through the State flood buyout program. This voluntary program has allowed families in flood prone areas to relocate out of harm's way. The acquired properties were then placed in public ownership with the appropriate deed restrictions. These restrictions will ensure that future use of these lands will not put the lives of Missouri citizens at risk from flood disasters.

Some communities throughout the state have continued this program by using local funds to acquire flood prone properties. This is a clear example of the impact of advertising mitigation success stories. Because of the success of this program, the acquisition of flood prone structures will continue to be a priority for any hazard mitigation funds available to the State.

The State also has an effective and proactive floodplain management program. Personnel from the floodplain management section of SEMA are continually conducting assistance visits, training classes, and site inspections in communities throughout the State. These efforts ensure that local government, private enterprises, and the citizens of the State are aware of the benefits of participating in the National Flood Insurance Program (NFIP).

There are currently 570 jurisdictions within the State of Missouri that are participating in the National Flood Insurance Program (NFIP). This total is comprised of 555 communities in the regular program and 15 communities in the emergency program. All of these have established local floodplain management ordinances to help them administer the program. At the present time there are 89 jurisdictions within the State of Missouri that are not in the National Flood Insurance Program (NFIP) that have hazard areas identified. Twelve (12) jurisdictions are currently suspended. This total (12) is comprised of 11 communities suspended from the regular program and 1 community suspended from the emergency program.

The State has several floodplain mapping initiatives in progress. There are approximately 130 jurisdictions throughout the State that are in the process of being mapped at this time. Funding for this mapping initiative has come from a variety of federal, state, and local sources.

Through the FEMA Pre-Disaster Mitigation (formerly Project Impact) program and the State's Disaster Resistant Community program, the civic and political leaders of eight (8) communities within the State have taken the opportunity and initiative to develop and institute sound mitigation actions in their respective communities.

While there are only eight communities that have been formally recognized as "Disaster Resistant Communities", there are many others that are actively developing local hazard mitigation programs and conducting hazard mitigation activities.

As a result of these mitigation initiatives, local government and private industry have formed partnerships that have worked together to make the State, their communities, and its citizens safer and more prepared for the next potential disaster. Their actions will help ensure that future disasters have less of an impact on lives, property, and infrastructure within their community and within the State.

## 4.5 Funding Sources

**Requirement 44 CFR §201.4(c)(3) (iv): The mitigation strategy shall include identification of current and potential sources of Federal, State, local, or private funding to implement mitigation activities.**

**Table 49** provides a matrix that addresses the current and potential sources of funding for federal/state/local hazard mitigation programs, activities, and initiatives. The matrix identifies the program activity, type of assistance, and the responsible agency and point of contact.

The following "Programs/Activities" are addressed in the matrix on the following page:

General Emergency grants, loans, and assistance;  
 Floods/Flood Control grants, loans, and assistance;  
 Earthquake grants, loans, and assistance;  
 All-Hazard Mapping grants, loans, and assistance;  
 Ancillary Flood & Natural Resource Projects grants, loans, and assistance;  
 Basic and Applied Research/Development grants, loans, and assistance;  
 Other Planning Information, including Demographics, Societal Data, Transportation, Agricultural, Industrial, and Other Commercial Economic Statistics.  
 Business Continuity Planning  
 Grants, loans, and technical assistance in addressing rehabilitation, health, safety, and emergency (fire, ambulance, sirens, etc.) facilities and equipment needs in primarily low-income rural areas.

**Table 49. Federal / State Mitigation Programs, Activities, & Initiatives**

<b>Program / Activity</b>	<b>Type of Assistance</b>	<b>Agency &amp; Contact</b>
<b>General Emergency Grants, Loans &amp; Assistance</b>	<b>Pre/Post Disaster Mitigation, Relief, Recovery, Training, &amp; Technical Assistance.</b>	
Hazard Mitigation Grant Program	Grants to States and communities for implementing long-term hazard mitigation measures following a major disaster declaration.	FEMA Region VII NFIP & Mitigation (816) 283-7002  Missouri State Emergency Management Agency (SEMA) Tel: (573) 526-9116 Fax: (573) 526-9193 <a href="mailto:Samin@sema.state.mo.us">Samin@sema.state.mo.us</a>
Disaster Mitigation Planning and Technical Assistance	Technical and planning assistance for capacity building and mitigation project activities focusing on creating disaster resistant jobs and workplaces.	Department of Commerce (DOC), Economic Development Administration (EDA) (Note: May have grant funding): (800) 345-1222 EDA's Disaster Recovery Coordinator: (202) 482-6225 <a href="http://www.doc.gov/eda">www.doc.gov/eda</a>  Missouri State Emergency Management Agency (SEMA) (Technical Assistance Only): Tel: (573) 526-9116 Fax: (573) 526-9193 <a href="mailto:Samin@sema.state.mo.us">Samin@sema.state.mo.us</a>

Pre-Disaster Mitigation	Funding and technical assistance to communities and States to implement pre-disaster mitigation projects and planning.	<p>FEMA Region VII NFIP &amp; Mitigation (816) 283-7002</p> <p>Missouri State Emergency Management Agency (SEMA) (Technical Assistance Only) Tel: (573) 526-9116 Fax: (573) 526-9193 <a href="mailto:Samin@sema.state.mo.us">Samin@sema.state.mo.us</a></p>
Emergency Management / Mitigation Training	Training in disaster mitigation, preparedness, planning.	<p>FEMA Region VII NFIP &amp; Mitigation (816) 283-7002</p> <p>Missouri State Emergency Management Agency (SEMA) Tel: (573) 526-9116 Fax: (573) 526-9193 <a href="mailto:Samin@sema.state.mo.us">Samin@sema.state.mo.us</a></p>
Post-Disaster Economic Recovery Grants and Assistance	Grant funding to assist with the long-term economic recovery of communities, industries, and firms adversely impacted by disasters.	<p>Department of Commerce (DOC) – Economic Development Administration (EDA) EDA Headquarters Disaster Recovery Coordinator: (202) 482-6225</p> <p>Missouri Department of Economic Development CDBG Program Tel: (573) 751-4146</p>
Physical Disaster Loans and Economic Injury Disaster Loans	Disaster loans to non-farm, private sector owners of disaster damaged property for uninsured losses. Loans can be increased by up to 20 percent for mitigation purposes.	<p>Small Business Administration (SBA) National Headquarters Associate Administrator for Disaster Assistance: (202) 205-6734</p>
Public Assistance Program (Infrastructure)	Grants to States and communities to repair damaged infrastructure and public facilities, and help restore government or government-related services. Mitigation funding is available for work related to damaged components of the eligible building or structure.	<p>FEMA Region VII NFIP &amp; Mitigation (816) 283-7002</p> <p>Missouri State Emergency Management Agency (SEMA) Tel: (573) 526-9112 Fax: (573) 526-9193 <a href="mailto:cmay@sema.state.mo.us">cmay@sema.state.mo.us</a></p>

<p>Public Infrastructure Grants (CDBG)  Annual Competition – Public Facilities  Annual Competition – Neighborhoods  Annual Competition – Infrastructure  Downtown Revitalization  Emergencies</p>	<p><i>Public Facilities:</i> Grants for public improvement or facilities except work on general public office buildings, includes water facilities, flood and drainage facilities, fire protection facilities/equipment and bridges.  <i>Neighborhoods:</i> Grants for housing and some public facilities.  <i>Infrastructure:</i> Grants for storm sewers, drainage and land acquisitions.  <i>Downtown Revitalization:</i> Grants for improving public infrastructure and facilities in a central business district.  <i>Emergencies:</i> Grants for public improvement or facilities except work on general public office buildings, includes water facilities and solid waste disposal facilities.</p>	<p>Missouri Department of Economic Development  CDBG Program  Tel: (573) 751-4146  Tel: (573) 751-3600  Fax: (573) 526-4157</p>
<p>Community Development Block Grant (CDBG) State Administered Program</p>	<p>Grants to States to develop viable communities (e.g., housing, a suitable living environment, expanded economic opportunities) in non-entitled areas, for low- and moderate-income persons.</p>	<p>US Department of Housing and Urban Development (HUD)  State CDBG Program Manager  Or  State and Small Cities Division,  Office of Block Grant Assistance,  HUD Headquarters:  (202) 708-3587   Missouri Department of Economic Development  Tel: (573) 751-4146</p>
<p>Community Development Block Grant (CDBG)  Entitlement Communities Program</p>	<p>Grants to entitled cities and urban counties to develop viable communities (e.g., decent housing, a suitable living environment, expanded economic opportunities), principally for low- and moderate-income persons.</p>	<p>HUD  City and county applicants should call the Community Planning and Development staff of their appropriate HUD field office. As an alternative, they may call the Entitlement Communities Division, Office of Block Grant Assistance, HUD Headquarters:  (202) 708-1577, 3587</p>

		Missouri Department of Economic Development CDBG Program Tel: (573) 751-4146
Disaster Recovery Initiative	Grants to fund gaps in available recovery assistance after disasters (including mitigation).	HUD Community Planning and Development Divisions in their respective HUD field offices or HUD Community Planning and Development: (202) 708-2605  Missouri Department of Economic Development Missouri Housing Development Commission (816) 759-6600
Public Housing Modernization Reserve for Disasters and Emergencies	Funding to public housing agencies for modernization needs resulting from natural disasters (including elevation, flood proofing, and retrofit).	HUD Director, Office of Capital Improvements: (202) 708-1640  Missouri Department of Economic Development Missouri Housing Development Commission (816) 759-6600
Indian Housing Assistance (Housing Improvement Program)	Project grants and technical assistance to substantially eliminate sub-standard Indian housing.	Department of Interior (DOI)-Bureau of Indian Affairs (BIA) Division of Housing Assistance, Office of Tribal Services: (202) 208-5427
Section 504 Loans for Housing	Repair loans, grants and technical assistance to very low-income senior homeowners living in rural areas to repair their homes and remove health and safety hazards.	US Department of Agriculture (USDA) – Rural Housing Service (RHS) Contact local RHS Field Office, or RHS Headquarters, Director, Single Family Housing Direct Loan Division: (202) 720-1474
Section 502 Loan and Guaranteed Loan Program	Provides loans, loan guarantees, and technical assistance to very low and low-income applicants to purchase, build, or rehabilitate a home in a rural	USDA-RHS Contact the Local RHS Field Office, or the Director, Single Family Housing Guaranteed Loan Division,



	area.	RHS: (202) 720-1452
Farm Ownership Loans	Direct loans, guaranteed / insured loans, and technical assistance to farmers so that they may develop, construct, improve, or repair farm homes, farms, and service buildings, and to make other necessary improvements.	USDA-FSA Director, Farm Programs Loan Making Division, FSA: (202) 720-1632  Missouri Department of Agriculture (573) 751-4211
HOME Investments Partnerships Program	Grants to States, local government and consortia for permanent and transitional housing (including support for property acquisition and rehabilitation) for low-income persons.	HUD Community Planning and Development, Grant Programs, Office of Affordable Housing, HOME Investment Partnership Programs: (202) 708-2685 (202) 708 0614 extension 4594 1-800-998-9999  Missouri Department of Economic Development Missouri Housing Development Commission (816) 759-6600
Rural Development Assistance – Housing	Grants, loans, and technical assistance in addressing rehabilitation, health and safety needs in primarily low-income rural areas. Declaration of major disaster necessary.	USDA-Rural Housing Service (RHS) Community Programs: (202) 720-1502 Single Family Housing: (202) 720-3773 Multi Family Housing: (202) 720-5177 Missouri State Rural Development Office Tel: (573) 876-0976 Fax: (573) 876-0977
Rural Development Assistance -- Utilities	Direct and guaranteed rural economic loans and business enterprise grants to address utility issues and	USDA-Rural Utilities Service (RUS) Program Support: (202) 720-1382

	development needs.	Missouri State Rural Development Office Tel: (573) 876-0976 Fax: (573) 876-0977
Rural Development Assistance – Community Facility Direct Loans/Grants	Grants, loans, and technical assistance in addressing rehabilitation, health, safety, and emergency (fire, ambulance, sirens, etc.) facilities and equipment needs in primarily low-income rural areas.	USDA-Rural Housing Service (RHS) Community Programs: (202) 720-1502 Missouri State Rural Development Office Tel: (573) 876-0976 Fax: (573) 876-0977
Rural Community Fire Protection	Grants for rural fire projects or assistance, including dry fire hydrants, equipment and training.	Missouri Department of Conservation (573) 751-4115 x-3111-Program Information (573) 346-2210-Applications, Program Information, & Grant Management <a href="http://www.conservation.state.mo.us/forest/">www.conservation.state.mo.us/forest/</a>
Section 108 Loan Guarantee Program	Loan guarantees to public entities for community and economic development (including mitigation measures).	HUD Community Planning and Development staff at appropriate HUD field office, or the Section 108 Office in HUD Headquarters: (202) 708-1871  Missouri Department of Economic Development Missouri Housing Development Commission (816) 759-6600
<b>Floods/Flood Control Grants, Loans &amp; Assistance</b>	<b>Floods/Flood Control Technical/Planning Assistance and Program Support.</b>	
National Flood Insurance Program	Makes available flood insurance to residents of communities that adopt and enforce minimum floodplain management requirements.	FEMA Region VII NFIP & Mitigation (816) 283-7002  Missouri State Emergency Management Agency (SEMA) Tel: (573) 526-9141 Fax: (573) 526-9198

		<a href="mailto:griedel@sema.state.mo.us">griedel@sema.state.mo.us</a>
Flood Mitigation Assistance	<p>Grants to States and communities for pre-disaster mitigation to help reduce or eliminate the long-term risk of flood damage to structures insurable under the National Flood Insurance Program.</p> <p>Note: Requires flood mitigation plan to be developed by the community seeking grant funding.</p>	<p>FEMA Region VII NFIP &amp; Mitigation (816) 283-7002</p> <p>Missouri State Emergency Management Agency (SEMA) Tel: (573) 526-9116 Fax: (573) 526-9193 <a href="mailto:Samin@sema.state.mo.us">Samin@sema.state.mo.us</a></p>
Flood Control Planning Assistance	Technical and planning assistance for the preparation of comprehensive plans for the development, utilization, and conservation of water and related land resources.	<p>Department of Defense (DOD) US Army Corps of Engineers (USACE) Contact the Floodplain Management Staff in the Appropriate USACE Regional Office</p> <p>N.W. MO – Omaha District: (212) 264-7813</p> <p>N.E. MO – Rock Island District: (309) 794-5249</p> <p>W. Central MO – Kansas City District: (816) 983-3205</p> <p>E. Central MO – St. Louis District: (314) 331-8095</p> <p>Southern MO – Little Rock District: (501) 324-5551</p> <p>S. E. MO – Memphis District: (800) 317-4156</p>
Non-Structural Alternatives to Structural Rehabilitation of Damaged Flood Control Works	Direct planning and construction grants for non-structural alternatives to the structural rehabilitation of flood control works damaged in floods or coastal storms. \$9 million FY99	<p>DOD-USACE Emergency Management contact in respective USACE field office:</p> <p>N.W. MO – Omaha District: (212) 264-7813</p> <p>N.E. MO – Rock Island District: (309) 794-5249</p>

		<p>W. Central MO – Kansas City District: (816) 983-3205</p> <p>E. Central MO – St. Louis District: (314) 331-8095</p> <p>Southern MO – Little Rock District: (501) 324-5551</p> <p>S. E. MO – Memphis District: (800) 317-4156</p>
Floodplain Management Services	Technical and planning assistance at the local, regional, or national level needed to support effective floodplain management.	<p>DOD-USACE (U.S. Army Corps of Engineers)</p> <p>N.W. MO – Omaha District: (212) 264-7813</p> <p>N.E. MO – Rock Island District: (309) 794-5249</p> <p>W. Central MO – Kansas City District: (816) 983-3205</p> <p>E. Central MO – St. Louis District: (314) 331-8095</p> <p>Southern MO – Little Rock District: (501) 324-5551</p> <p>S. E. MO – Memphis District: (800) 317-4156</p> <p>Missouri State Emergency Management Agency (SEMA) Tel: (573) 526-9116 Fax: (573) 526-9193 <a href="mailto:Samin@sema.state.mo.us">Samin@sema.state.mo.us</a></p>
Land Protection	Technical assistance for run-off retardation and soil erosion prevention to reduce hazards to life and property.	<p>USDA-NRCS</p> <p>Applicants should contact the National NRCS office: (202) 720-4527</p>
Stormwater Grant Program	Grants for planning and construction of stormwater facilities.	Missouri Department of Natural Resources (DNR) Stormwater Grant Program

	<p>Only 1<sup>st</sup> Class Counties, cities in 1<sup>st</sup> Class Counties, &amp; St. Louis City eligible.</p> <p>Funds based on population base. County offices can approve/deny a city application (if population less than 25,000).</p> <p>Missouri 1<sup>st</sup> Class Counties:</p> <table> <tr> <td>Boone</td><td>Cole</td><td>Jefferson</td></tr> <tr> <td>Buchanan</td><td>Franklin</td><td>Platte</td></tr> <tr> <td>Camden</td><td>Greene</td><td>St. Charles</td></tr> <tr> <td>Cape Girardeau</td><td>Jackson</td><td>St. Louis</td></tr> <tr> <td>Clay</td><td>Jasper</td><td></td></tr> </table>	Boone	Cole	Jefferson	Buchanan	Franklin	Platte	Camden	Greene	St. Charles	Cape Girardeau	Jackson	St. Louis	Clay	Jasper		<p>Tel: (573) 751-1302</p>
Boone	Cole	Jefferson															
Buchanan	Franklin	Platte															
Camden	Greene	St. Charles															
Cape Girardeau	Jackson	St. Louis															
Clay	Jasper																
Dam Safety Programs	<p>Technical assistance, training, and grants to help improve State dam safety programs.</p>	<p>FEMA Region VII NFIP &amp; Mitigation (816) 283-7002</p> <p>Missouri Department of Natural Resources (DNR) Dam Safety Program Tel: (573) 368-2177 Fax: (573) 368-2111 1-800-334-6946 TDD: 1-800-379-2419E-mail: <a href="mailto:dams@mail.dnr.state.mo.us">dams@mail.dnr.state.mo.us</a></p>															

<b>Earthquake Grants, Loans &amp; Assistance</b>	<b>Earthquake Mitigation, Relief, Recovery, Technical/Planning/ Training Grant/Loan Assistance and Program Support.</b>	
National Earthquake Hazard Reduction Program	Technical and planning assistance for activities associated with earthquake hazards mitigation.	<p>FEMA, DOI-USGS Earthquake Program Coordinator: (703) 648-6785</p> <p>FEMA Region VII NFIP &amp; Mitigation (816) 283-7002</p> <p>Missouri State Emergency Management Agency (SEMA) Tel: (573) 526-9131 Fax: (573) 634-7966 <a href="mailto:Egray01@mail.state.mo.us">Egray01@mail.state.mo.us</a></p>
Geological Survey Program	Acquire, maintain and manage basic geological data; identify and evaluate geological hazards. The Geological Survey Program assists Missourians, industry, and government in the wise use of the state's minerals, land, and water resources.	<p>Department of Natural Resources Division of Geology and Land Survey Geological Survey Program (573) 368-2300 TDD: 1-800-379-2419 <a href="mailto:gspgeol@mail.dnr.state.mo.us">gspgeol@mail.dnr.state.mo.us</a></p>
Other Earthquake Hazards Reduction Programs	Training, planning and technical assistance under grants to States or local jurisdictions.	<p>FEMA Region VII NFIP &amp; Mitigation (816) 283-7002</p> <p>DOI-USGS Earthquake Program Coordinator: (703) 648-6785</p> <p>Missouri State Emergency Management Agency (SEMA) Tel: (573) 526-9131 Fax: (573) 634-7966 <a href="mailto:Egray01@mail.state.mo.us">Egray01@mail.state.mo.us</a></p>

<b>All-Hazard Mapping Grants, Loans &amp; Assistance &amp; Technical Assistance</b>	<b>All-Hazard Analysis &amp; Mapping of Flood Plains, Watersheds, Earthquake Areas, At-Risk Populations.</b>	
National Flood Insurance Program: Flood Mapping;	Flood insurance rate maps and flood plain management maps for all NFIP communities;	<p>FEMA Region VII NFIP &amp; Mitigation (816) 283-7002</p> <p>Missouri State Emergency Management Agency (SEMA) Tel: (573) 526-9141 Fax: (573) 526-9198 <a href="mailto:griedel@sema.state.mo.us">griedel@sema.state.mo.us</a></p>
National Flood Insurance Program: Technical Mapping Advisory Council	Technical guidance and advice to coordinate FEMA's map modernization efforts for the National Flood Insurance Program.	<p>DOI-USGS USGS – National Mapping Division: (573) 308-3802</p> <p>Missouri State Emergency Management Agency (SEMA) Tel: (573) 526-9141 Fax: (573) 526-9198</p>
National Digital Orthophoto Program	Develops topographic quadrangles for use in mapping of flood and other hazards.	<p>DOI-USGS USGS – National Mapping Division: (573) 308-3802</p> <p>Missouri State Emergency Management Agency (SEMA) Tel: (573) 526-9141 Fax: (573) 526-9198</p>
Stream Gaging and Flood Monitoring Network	Operation of a network of over 7,000 stream gaging stations that provide data on river flood characteristics.	<p>DOE-USGS Chief, Office of Surface Water, (703) 648-5303</p>
Mapping Standards Support	Expertise in mapping and digital data standards to support the National Flood Insurance Program.	<p>DOI-USGS USGS – National Mapping Division: (573) 308-3802</p> <p>Missouri State Emergency Management Agency (SEMA) Tel: (573) 526-9141 Fax: (573) 526-9198</p>

National Earthquake Hazards Reduction Program	Seismic mapping for U.S.	DOI-USGS Earthquake Program Coordinator: (703) 648-6785  Missouri State Emergency Management Agency (SEMA) Tel: (573) 526-9212 Fax: (573) 634-7966
<b>Ancillary Flood &amp; Natural Resource Projects Grants, Loans &amp; Assistance</b>	<b>Watershed Management, Clean Water, Conservation, Environmental, Forestry, Grant/Loan Assistance, Technical Aid, and Program Support</b>	
Natural Resources Financial Assistance	<p>DNR participates in a variety of financial and technical assistance programs that are available to Missouri communities.</p> <ul style="list-style-type: none"> <li>• User Charge Analysis - Computer software assisted analysis of water and wastewater user charge systems.</li> <li>• Agriculture Loan Program - Loans to individual farmers for animal waste treatment facilities.</li> <li>• Cooperative Remonumentation Program - Contract with county commissions to remonument corners of the U.S. Public Land Survey System.</li> <li>• County Boundary Resurvey Program - Contract with county commissions to remonument county boundary lines where the location of the line is indefinite.</li> <li>• Geodetic Control Densification Project - Contract with county, city government and municipal utilities to establish horizontal and vertical control monuments used for mapping</li> </ul>	<p>Missouri Department of Natural Resources (DNR) Tel: (573) 751-3443 1-800-334-6946 TDD: 1-800-379-2419 E-mail: webmanager@mail.dnr.state.mo.us</p> <p>Technical Assistance Program (573) 526-6627</p> <p>Missouri Department of Agriculture (573) 751-2129</p> <p>State Surveyor (573) 368-2301</p> <p>State Surveyor (573) 368-2301</p> <p>State Surveyor (573) 368-2301</p>



	<p>and the development of land survey information system.</p> <ul style="list-style-type: none"> <li>• Hazardous Substance Emergency Relief Loan Fund - Loans to political subdivisions or volunteer fire protection associations for reimbursement of actual costs incurred in responding to a hazardous substance emergency.</li> <li>• Local Government Reimbursement Program - Local communities can be reimbursed up to \$25,000 for cost incurred in responding to a hazardous substance emergency.</li> <li>• Leaking Underground Storage Tank Cleanup Assistance - At eligible sites with pre-approved plans and costs, the Underground Storage Tank Fund can assist the responsible party with the cleanup costs.</li> <li>• Private Activity Bond Financing Issuance of tax-exempt and taxable revenue bonds for private and public companies for facilities and improvements with environmental and energy resource impacts.</li> </ul>	<p>Environmental Services Program (573) 526-3346</p> <p>U. S. EPA, Local Government Reimbursement Help Line 1-800-431-9209</p> <p>Hazardous Waste Management Program (573) 751-3176</p> <p>Environmental Improvement and Energy Resources Authority (573) 751-4919</p>
Environmental Quality Incentives Program (EQIP)	<p>Technical, educational, and limited financial assistance to encourage environmental enhancement.</p> <p>DNR Completed Audits, Cost-Share, Fees and Taxes, Financial Assurance Review, Grants, Loans, Non-Profit Reimbursement, State Revolving Fund (SRF), Vehicle Emissions Repair Assistance (VERA)</p> <p>Air Pollution Control Program</p> <p>Air Pollution Control Sales Tax Exemptions, Vehicle Emissions</p>	<p>USDA-NRCS NRCS County Offices Or NRCS EQUIP Program Manager: (202) 720-1834 <a href="http://www.nrcs.usda.gov">www.nrcs.usda.gov</a> Columbia, MO District Office – USDA-NRCS Tel: (573) 876-0912 Fax: (573) 875-0913</p> <p>Missouri Department of Natural Resources (DNR) Tel: (573) 751-3443 Division of Environmental Quality</p>

	<p>Repair Assistance</p> <p>Environmental Services Program</p> <p>Hazardous Substance Emergency Relief Loan Fund</p> <p>Hazardous Waste Program</p> <p>Brownfield Pilot Projects, Fees and Taxes, Financial Assurance Review, Leaking Underground Storage Tank Cleanup Assistance, Natural Resources Damage Assessments, Petroleum Storage Tank Cleanup Assistance, Voluntary Cleanup Program Financial Incentives</p> <p>Public Drinking Water Program</p> <p>Rural Drinking Water Grant Program, State Revolving Fund (SRF Leveraged Loan Program</p> <p>Soil and Water Conservation Program</p> <p>Assistance to Districts, Cost-Share Grants, Cooperative Grants with the Missouri Department of Conservation, Loan Interest-Share, Research Grants, Special Area Land Treatment Program (SALT)</p> <p>Solid Waste Management Program</p> <p>Completed District Audits, District Grants, District Administration Grants, Non-Profit Group Waste Tire Cleanup Cost Reimbursement Instruction Sheet, Financial Assurance Instruments, Waste Tire Grant information, Financial Assistance, Waste Reduction and Recycling Projects</p> <p>Technical Assistance Program</p>	<p>1-800-334-6946</p> <p>TDD: 1-800-379-2419</p> <p>E-mail: <a href="mailto:tap@mail.dnr.state.mo.us">tap@mail.dnr.state.mo.us</a></p>
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	<p>Agricultural Assistance, Business Assistance, Government Assistance, On-site Assessment Team, Pollution Prevention, Small Business Assistance</p> <p>Water Pollution Control Program</p> <p>Nonpoint Source Minigrants, Nonpoint Source Animal Waste Treatment Facility Loan Program, Nonpoint Source Project Grants, State 40 Percent Construction Wastewater Grant Program, State Revolving Fund (SRF) Leveraged Load Program - Wastewater, Storm Water Grant and Loan Program, Water Pollution Equipment Sales Tax Exemption</p>	
Clean Water Act Section 319 Grants	Grants to States to implement non-point source programs, including support for non-structural watershed resource restoration activities.	<p>EPA Office of Water Chief, Non-Point Source Control Branch: (202) 260-7088, 7100</p> <p>Missouri Department of Natural Resources (DNR) Tel: (573) 751-3443 Division of Environmental Quality Public Drinking Water Program 1-800-334-6946 TDD: 1-800-379-2419 E-mail: drinkingwater@mail.dnr.state.mo.us</p>
Clean Water State Revolving Funds	Loans at actual or below-market interest rates to help build, repair, relocate, or replace wastewater treatment plants.	<p>EPA EPA Office of Water State Revolving Fund Branch Branch Chief: (202) 260-7359 A list of Regional Offices is available upon request</p>
Wetlands Protection – Development Grants	Grants to support the development and enhancement of State and tribal wetlands protection programs.	<p>US Environmental Protection Agency (EPA) EPA Wetlands Hotline: (800) 832-</p>

		<p>7828 Or EPA Headquarters, Office of Water Chief, Wetlands Strategies and State Programs: (202) 260-6045</p> <p>Missouri Department of Natural Resources (DNR) Tel: (573) 751-3443</p>
<p>Watershed Protection and Flood Prevention Program and Soil and Water Conservation Program</p>	<p>Technical and financial assistance for installing works of improvement to protect, develop, and utilize land or water resources in small watersheds under 250,000 acres.</p>	<p>USDA-NRCS Director, Watersheds and Wetlands Division: (202) 720-3042 (202) 690-4614 <a href="http://www.nrcs.usda.gov">www.nrcs.usda.gov</a> Columbia, MO District Office – USDA-NRCS Tel: (573) 876-0912 Fax: (573) 875-0913</p> <p>Missouri Department of Natural Resources (DNR) Tel: (573) 751-3443 Division of Environmental Quality Soil and Water Conservation Program 1-800-334-6946 TDD: 1-800-379-2419 E-mail: <a href="mailto:soils@mail.dnr.state.mo.us">soils@mail.dnr.state.mo.us</a></p>
<p>Watershed Surveys and Planning Small Watershed Protection Act (PL 566)</p>	<p>Surveys and planning studies for appraising water and related resources, and formulating alternative plans for conservation use and development. Grants and advisory/counseling services to assist w/planning and implementing improvement.</p>	<p>US Department of Agriculture (USDA) – National Resources Conservation Service (NRCS) Watersheds and Wetlands Division: (202) 720-4527 Deputy Chief for Programs: (202) 690-0848 <a href="http://www.nrcs.usda.gov">www.nrcs.usda.gov</a>  Columbia, MO District Office – USDA-NRCS Tel: (573) 876-0912</p>
<p>Emergency Watershed</p>	<p>Provides technical and financial</p>	<p>USDA – NRCS</p>

Protection Program	assistance for relief from imminent hazards in small watersheds, and to reduce vulnerability of life and property in small watershed areas damaged by natural hazard events.	National Office – (202) 690-0848 Watersheds and Wetlands Division: (202) 720-3042
Wetlands Reserve Program	Financial and technical assistance to protect and restore wetlands through easements and restoration agreements.	USDA-NRCS National Policy Coordinator NRCS Watersheds and Wetlands Division: (202) 720-3042
Project Modifications for Improvement of the Environment	Provides for ecosystem restoration by modifying structures and/or operations or water resources projects constructed by the USACE, or restoring areas where a USACE project contributed to the degradation of an area.	DOD-USACE Chief of Planning @ appropriate USACE Regional Office N.W. MO – Omaha District: (212) 264-7813 N.E. MO – Rock Island District: (309) 794-5249 W. Central MO – Kansas City District: (816) 983-3205 E. Central MO – St. Louis District: (314) 331-8095 Southern MO – Little Rock District: (501) 324-5551 S. E. MO – Memphis District: (800) 317-4156
Aquatic Ecosystem Restoration	Direct support for carrying out aquatic ecosystem restoration projects that will improve the quality of the environment.	DOD-USACE Chief of Planning @ appropriate USACE Regional Office (U.S. Army Corps of Engineers) N.W. MO – Omaha District: (212) 264-7813 N.E. MO – Rock Island District: (309) 794-5249 W. Central MO – Kansas City District: (816) 983-3205 E. Central MO – St. Louis District: (314) 331-8095 Southern MO – Little Rock District: (501) 324-5551 S. E. MO – Memphis District: (800) 317-4156  Streams for the Future Fisheries Division

		Missouri Department of Conservation (573) 751-4115
Water Resources Development Act or Challenge 21	Financial and technical assistance to prepare comprehensive plans for the development, use and conservation of water and related land resources.	DOD-USACE Chief of Planning @ appropriate USACE Regional Office (U.S. Army Corps of Engineers) N.W. MO – Omaha District: (212) 264-7813 N.E. MO – Rock Island District: (309) 794-5249 W. Central MO – Kansas City District: (816) 983-3205 E. Central MO – St. Louis District: (314) 331-8095 Southern MO – Little Rock District: (501) 324-5551 S. E. MO – Memphis District: (800) 317-4156  Streams for the Future Fisheries Division Missouri Department of Conservation (573) 751-4115
Beneficial Uses of Dredged Materials	Direct assistance for projects that protect, restore, and create aquatic and ecologically-related habitats, including wetlands, in connection with dredging an authorized Federal navigation project.	DOD-USACE Same as above
North American Wetland Conservation Fund	Cost-share grants to stimulate public/private partnerships for the protection, restoration and management of wetland habitats.	DOI-FWS North American Waterfowl and Wetlands Office: (703) 358-1784
Soil Survey	Maintains soil surveys of counties or other areas to assist with farming, conservation, mitigation or related purposes.	USDA-NRCS NRCS – Deputy Chief for Soil Science and Resource Assessment: (202) 720-4630

Land Acquisition	Acquires or purchases easements on high-quality lands and waters for inclusion into the National Wildlife Refuge System.	DOI-FWS Division of Realty National Coordinator: (703) 358-1713
Transfers of Inventory Farm Properties to Federal and State Agencies for Conservation Purposes	Transfers title of certain inventory farm properties owned by FSA to Federal and State agencies for conservation purposes (including the restoration of wetlands and floodplain areas to reduce future flood potential)	US Department of Agriculture (USDA) – Farm Service Agency (FSA) Farm Loan Programs National Office: (202) 720-3467, 1632
Federal Land Transfer / Federal Land to Parks Program	Identifies, assesses, and transfers available Federal real property for acquisition for State and local parks and recreation, such as open space.	DOI-NPS General Services Administration Offices Fort Worth, TX: (817) 334-2331 Boston, MA: (617) 835-5700 Or Federal Lands to Parks Leader NPS National Office: (202) 565-1184
Recreation and Parks Grants	Grants available to cities, counties and school districts to be used for outdoor recreation facilities and land acquisition.	Missouri Department of Natural Resources Division of Parks Tel: (573) 751-8560 Fax: (573) 526-4395
Partners for Fish and Wildlife	Financial and technical assistance to private landowners interested in pursuing restoration projects affecting wetlands and riparian habitats.	Department of Interior (DOI) – Fish and Wildlife Service (FWS) National Coordinator, Ecological Services: (703) 358-2201 A list of State and Regional contacts is available from the National Coordinator upon request.
Tree Planting Program	Grants for Planting Trees for improving Missouri's erosion control, conservation, stream bank stabilization, etc.	Missouri Department of Conservation (573) 751-4115 x-3111-Program Information (573) 751-4115 x-3116-Applications, Program Information,

		& Grant Management <a href="http://www.conservation.state.mo.us/forest/">www.conservation.state.mo.us/forest/</a>
Conservation Contracts	Debt reduction for delinquent and non-delinquent borrowers in exchange for conservation contracts placed on environmentally sensitive real property that secures FSA loans.	USDA-FSA Farm Loan Programs FSA National Office: (202) 720-3467, 1632 or local FSA office
Historic Preservation Fund Grants	<p>Federal matching grants, known as the Historic Preservation Fund (HPF), to assist the various states in carrying out historic preservation activities. Authorized by the National Historic Preservation Act of 1966.</p> <p>The program is sponsored by the Department of the Interior, National Park Service (NPS), and in Missouri, is administered through the Historic Preservation Program (HPP) of the Missouri Department of Natural Resources.</p>	<p>Missouri Department of Natural Resources (DNR) Tel: (573) 751-3443 Division of State Parks Historic Preservation Program 1-800-334-6946 TDD: 1-800-379-2419 E-mail: <a href="mailto:moshpo@mail.dnr.state.mo.us">moshpo@mail.dnr.state.mo.us</a></p>
The Foundation Directory	Annual source of information about grants & loans from federal and private sources. Available for a fee.	The Foundation Directory (800) 424-9836 <a href="http://www.fconline.fdncenter.org/">www.fconline.fdncenter.org/</a>
Federal Assistance Monitor	Published by CD Publications. Semi-monthly report on federal and private grants. Available for a fee.	CD Publications 8204 Fenton Street Silver Springs, MD 20910 Tel: (301) 588-6380 <a href="http://www.cdpublications.com/">www.cdpublications.com/</a>
<b>Basic &amp; Applied Research/Development Grants, Loans &amp; Assistance</b>	<b>Research and Educational Assistance Information, Grants/ Loans and Technical Assistance.</b>	
Center for Integration of Natural Disaster Information	Technical Assistance: Develops and evaluates technology for information integration and dissemination	Department of Interior (DOI) –US Geological Survey (USGS) The Center for Integration of Natural Hazards Research:



		(703) 648-6059 <a href="mailto:hazinfo@usga.gov">hazinfo@usga.gov</a>
Hazard Reduction Program	Funding for research and related educational activities on hazards.	National Science Foundation (NSF), Directorate for Engineering, Division of Civil and Mechanical Systems, Hazard Reduction Program: (703) 306-1360
Decision, Risk, and Management Science Program	Funding for research and related educational activities on risk, perception, communication, and management (primarily technological hazards)	NSF – Directorate for Social, Behavioral and Economic Science, Division of Social Behavioral and Economic Research, Decision, Risk, and Management Science Program (DRMS): (703) 306-1757 <a href="http://www.nsf.gov/sbe/drms/start.htm">www.nsf.gov/sbe/drms/start.htm</a>
Societal Dimensions of Engineering, Science, and Technology Program	Funding for research and related educational activities on topics such as ethics, values, and the assessment, communication, management and perception of risk	NSF – Directorate for Social, Behavioral and Economic Science, Division of Social, Behavioral and Economic Research, Societal Dimensions of Engineering, Science and Technology Program: (703) 306-1743
National Earthquake Hazard Reduction Program (NEHRP) in Earth Sciences	Research into basic and applied earth and building sciences.	NSF – Directorate for Geosciences, Division of Earth Sciences: (703) 306-1550
<b>Other Planning Information, Including Demographics, Societal Data, Transportation,</b>	<b>Low and/or No Cost Information Helpful for Determining At-Risk Populations and Potential Economic Damages &amp; Information</b>	

Agricultural, Industrial & Other Commercial Economic Statistics	to Help Determine Avoidance of Losses.	
Demographics, Societal Statistics and Economic Statistics	<p>Free Planning Information Concerning Jobs, Business and Economic Statistics, Population and Housing Statistics, and Help with Census Products (i.e., statistics, maps, reports, etc.), State Government, etc.</p> <p>Note: For statistics regarding clean water, wetlands, conservation, disasters, natural resources, rivers, and other subjects covered separately in this document, use the contact information already provided in those subject matter areas of this document.</p> <p>(For example, contact the Missouri Department of Natural Resources (DNR), Division of State Parks, Historic Preservation Program for statistics about Missouri's Historic Preservation Program, by looking for the contact information under <b>Historic Preservation Fund Grants</b> on page 14 of this document).</p>	<p>U.S. Census Bureau Washington DC 20233</p> <p>General telephone inquiries: 301-457-4608 <a href="mailto:webmaster@census.gov">webmaster@census.gov</a></p> <p>Bureau of Economic Analysis (BEA) 1441 L Street NW Washington DC 20230</p> <p>Public Information Office 202-606-9900 BEA Order Desk 800-704-0415 <a href="http://bea.doc.gov">bea.doc.gov</a> <a href="mailto:webmaster@bea.doc.gov">webmaster@bea.doc.gov</a></p> <p>Bureau of Labor Statistics Division of Information Services 2 Massachusetts Avenue, N.E. Room 2860 Washington, D. C. 20212</p> <hr/> <p>202-691-5200 800-877-8339 Fax 202-691-7890 <a href="mailto:blsdata_staff@bls.gov">blsdata_staff@bls.gov</a></p> <p>Missouri State Census Data Center Missouri State Library 600 W. Main Street PO Box 387 Jefferson City, MO 65102</p> <p>Ms. Debbie Pitts (573) 526-7648 FAX (573) 751-3612 <a href="mailto:pittsd@sosmail.state.mo.us">pittsd@sosmail.state.mo.us</a></p>

<p>Demographics, Societal Statistics and Economic Statistics (Continued)</p>	<p>Free Information Concerning Jobs, Business and Economic Statistics, Population and Housing Statistics, and Help with Census Products (i.e., statistics, maps, reports, etc.), State Government, etc.</p> <p><i>Note: For statistics regarding clean water, wetlands, conservation, disasters, natural resources, rivers, and other subjects covered separately in this document, use the contact information already provided in those subject matter areas of this document.</i></p> <p><i>(For example, contact the Missouri Department of Natural Resources (DNR), Division of State Parks, Historic Preservation Program for statistics about Missouri's Historic Preservation Program, by looking for the contact information under <b>Historic Preservation Fund Grants</b> on page 14 of this document).</i></p>	<p>Small Business Research Information Center 104 Nagogami Terrace University of Missouri-Rolla Rolla, MO 65409</p> <p>Mr. Fred Goss Ms. Cathy Frank (573) 341-6484</p> <p>Office of Administration 124 Capitol Building P.O. Box 809 Jefferson City, MO 65102 Mr. Ryan Burson (573) 751-2345 bursor@mail.oa.state.mo.us</p> <p>Office of Social &amp; Economic Data Analysis University of Missouri-Columbia 626 Clark Hall Columbia, MO 65211 Mr. John Blodgett (573) 884-2727 FAX(573) 884-4635</p> <p>Ms. Evelyn J. Cleveland blodgettj@umsystem.edu clevelande@umsystem.edu</p> <p>Geographic Resources Center University of Missouri-Columbia 17 Stewart Hall Columbia, MO 65211</p> <p>Mr. Tim Haithcoat (573) 882-2324 haithcoatt@missouri.edu</p> <p>Center for Economic Information University of Missouri-Kansas City 207 Haag Hall Kansas City, MO 64131</p> <p>Mr. Peter Eaton</p>
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## **5.0 LOCAL MITIGATION PLANNING COORDINATION**

### **5.1 Local Funding and Technical Assistance**

**Requirement 44 CFR §201.4(c)(4)(i):** The section should include a] description of the State process to support, through funding and technical assistance, the development of local mitigation plans.

#### **5.1.1 Background Information**

The State of Missouri is composed of 114 Counties and the City of St. Louis. Every County and the City of St. Louis has a Local Emergency Operations Plan (LEOP). These plans are scheduled for review and/or update by a SEMA planner about once every five years. Approximately 30 incorporated cities maintain separate Local Emergency Operations Plans, which are also included in the five year SEMA review/update process.

The Local Hazard Mitigation Plan will normally be a separate stand-alone plan by county and/or region. Some jurisdictions may develop their hazard mitigation plan as an Annex to their existing Local Emergency Operations Plan. Any jurisdiction within a county may prepare a mitigation plan specific to that jurisdiction, separate from the county mitigation plan. (The term “county plan” or “county hazard mitigation plan”, as used in this plan, refers to the hazard mitigation plan for the mentioned county and all incorporated jurisdictions within that county, unless otherwise stated.)

Because most jurisdictions will require some form of assistance in developing their local hazard mitigation plan, SEMA has a mitigation section and nine (9) Planner/Area Coordinators available to provide technical assistance to jurisdictions in the development of Local Hazard Mitigation Plans. Local mitigation plans normally will be completed as outlined in this Annex. However, the initial plans for most jurisdictions will be completed as described in the Technical Support section of this plan below.

#### **5.1.2 Technical Support**

Technical support will be the primary means by which SEMA assists local jurisdictions and the Regional Planning Commissions and/or Councils of Government in developing local mitigation plans. This support will be provided primarily by the following branches within SEMA:

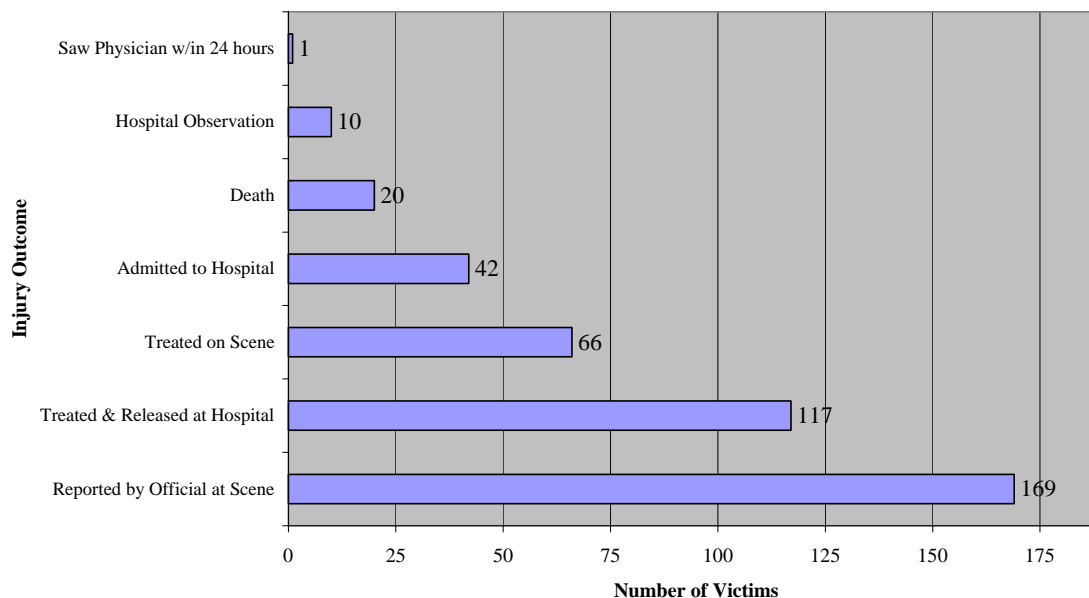
##### **Floodplain Management & Mitigation Assistance (FM&MA) Branch**

The mitigation section within this branch will be the main source of information and support in the mitigation planning process being conducted by the 19 Regional Planning Commissions and/or Councils of Government (RPCs) helping counties and local governments as part of their mitigation plan preparation and review process for developing local Hazard Mitigation Plans (initially for 55 counties and 571 jurisdictions), and will assist the P&DR Branch in working with the local jurisdictions in developing local hazard mitigation plans in instances where local jurisdictions decline the assistance of the RPCs. This section will provide program specific

information related to federal/state mitigation policy, state mitigation priorities, program administration, funding sources, project eligibility requirements, etc.

### Planning & Disaster Recovery (P&DR) Branch

The nine Planners/Area Coordinators within this branch will be a source of information and



support in the general planning process. These planners will provide guidance and assistance related to the plan development process and assist the FM&MA Branch in working with the local jurisdictions in developing local hazard mitigation plans.

### 5.1.3 Funding Support

Since funding for planning purposes is generally minimal and SEMA would be unable to provide planning funds to every jurisdiction that would require a local hazard mitigation plan, technical support will continue to be the primary method of providing planning assistance to local jurisdictions.

There are three primary sources of funds to assist local jurisdictions in developing local hazard mitigation plans:

#### Flood Mitigation Assistance (FMA)

FMA planning funds are received by the State on an annual basis. The amount of funds provided varies. As such, the State establishes priorities for the use of these funds. These funds are provided on a 75/25 cost share basis. The recipient must provide the 25% match. Planning funds can only be provided to jurisdictions that participate in the National Flood Insurance Program (NFIP).

#### Hazard Mitigation Grant Program (HMGP)

HMGP funds are based on a percentage (currently 7.5%) of the total federal share of funds received by the State as a result of a presidential disaster declaration. The State can use up to 7% of those HMGP funds for planning purposes and up to 5% for state initiative projects.

### **Pre-Disaster Mitigation**

Local Hazard Mitigation plans also are being funded by FEMA's Pre-Disaster Mitigation (PDM) program. PDM funding is being used from FY 2002 and FY2003 for the most part.

### **Disaster Resistant Universities**

Hazard Mitigation plans also may be funded through FEMA's Pre-Disaster Mitigation (PDM) competitive program for universities and colleges.

## **5.2 Local Plan Integration**

**Requirement 44 CFR §201.4(c)(4)(ii): The section should include a description of the State process and timeframe by which the local plans will be reviewed, coordinated, and linked to the State Mitigation Plan.**

This section provides a description of the State process to determine which jurisdictions within the State that will require the development of local and/or regional hazard mitigation plans. It will also identify the timeframe for the development of those plans. Communities that have been selected as either "distressed" and/or "targeted" are marked accordingly.

### **5.2.1 Background Information**

The State of Missouri is composed of 114 Counties and the City of St. Louis. In addition to the 114 counties and the City of St Louis there are approximately 950 communities within the State of Missouri. Of these 950 communities, approximately 774 of them have populations of 3,000 or less. And most of these jurisdictions will require some form of technical assistance from SEMA personnel in developing their local hazard mitigation plan.

FEMA guidance requires local governments to have an approved mitigation plan in place prior to November 2004 in order to receive hazard mitigation grant program (HMGP) project grants. FEMA guidance allows the FEMA Regional Director the ability to grant exceptions to this requirement in extraordinary circumstances, such as in a small and impoverished community, when justification is provided. In these cases, the plan must be completed within twelve months of the award of the project grant. Because funding for mitigation projects is at stake, it is important that the State and these communities know the status of the plan requirements prior to any potential disaster. As such, the State of Missouri is addressing the hazard mitigation plan exception as part of this State Hazard Mitigation Plan.

The Local Hazard Mitigation Plan will normally be a separate stand-alone multi-jurisdictional plan by county and/or region. Some jurisdictions may develop their hazard mitigation plan as an Annex to their existing Local Emergency Operations Plan. Any jurisdiction within a county may prepare a mitigation plan specific to that jurisdiction, separate from the county mitigation plan. SEMA has contracted with the 19 Regional Planning Commissions and/or Councils of Government (RPCs) to develop local mitigation plans, and also has a mitigation section and nine (9) Planner/Area Coordinators available to provide technical assistance in the development of Local Hazard Mitigation Plans.

### **5.2.2 Schedule for Development of Local Hazard Mitigation Plans**

Of the 114 counties located within the State of Missouri, there are approximately 177 municipalities, including the City of St Louis, with populations greater than 3,000. Based on these figures, and FEMA's proposed guidance, there are approximately 291 local hazard mitigation plans that would need to be developed and approved within the State of Missouri prior to the November 2004 deadline.

Based on the number of plans that must be developed, the requirements that must be met by each plan to be approved, and the limited availability of personnel and funds, SEMA has taken the following approach to meeting this federal requirement.

After of a thorough review of all options, SEMA contacted the Missouri Association of Councils of Government (MACOG) for assistance in developing these plans. This is the umbrella organization for all nineteen (19) Regional Planning Commissions (RPC) and/or Councils of Government in the State. The RPCs provided SEMA with a cost, by county, to develop a hazard mitigation plan for each county in their region. These plans would be required to:

Meet the requirements of the Disaster Mitigation Act of 2000 for local hazard mitigation plans,

Include the unincorporated parts of the county and all incorporated jurisdictions within the county, regardless of population, and

The natural disaster threats/analysis, hazard mitigation strategy, initiatives, etc for each incorporated jurisdiction must be specifically addressed in the plan.

As a result of two presidentially-declared disasters at the beginning of 2002, SEMA had a limited amount of planning funds available. The decision was made to use these funds to help meet the local hazard mitigation planning requirement. Since these funds were not sufficient to develop all of the required plans, SEMA developed criteria for the selection of counties to be funded. These criteria are as follows:

County's relationship to major rivers;

Population;

Number of federal disaster declarations (25 years);

Participation in the National Flood Insurance Program (NFIP);

Mitigation funding in the past; and

Selection of some counties in every region of the State.

As additional funds become available, counties that were not included in the initial selection of 55 counties covering 571 jurisdictions will be prioritized and added. Non-selected counties will be provided with planning documents and guidance as requested/needed. Staff from the Mitigation section and Planner/Area Coordinators of the Natural and Technological Hazard Planning Branch will be available to provide planning guidance as needed. SEMA also will contact with the RPCs for assistance in developing these plans where local governments are prepared to provide the non-federal match.



The initial county multi-jurisdictional plans funded by this planning project will be completed within the established deadline. Due to the extensive FEMA requirements for these plans and the limited availability of personnel and funds at both the State and local levels, it is impossible to determine when the non-selected counties will have their plans completed. Every effort will be made to complete these local hazard mitigation plans as soon as practicable.

Under FEMA's guidelines, some communities may qualify for funding if their hazard mitigation plans are developed within twelve months of the award of the hazard mitigation project grant. The State of Missouri has identified approximately 774 communities that have a population of 3,000 or less. Within these jurisdictions, the Missouri Department of Economic Development has identified distressed and targeted communities.

### **Distressed Communities**

These communities were defined and identified as part of State of Missouri House Bill 1567 (June 1998). This bill defines a distressed community as follows:

Any city in a metropolitan area which has a median household income of under 70% of the median income for the entire metropolitan area;

Any census block group in a metropolitan area or contiguous block groups with a population of at least 2,500 which has a median household income of under 70% of the median income for the entire metropolitan area;

Any city not located in a metropolitan area which has a median household income of under 70% of the median income for the entire non-metropolitan area of the State; or

Any census block group or contiguous block groups with a population of at least 2,500 not located in a metropolitan area which has a median household income of under 70% of the median income for the entire non-metropolitan area of the State.

### **Targeted Communities**

These communities were defined and identified by the Missouri Department of Economic Development Community Development Block Grant (CDBG) program. The department used several factors to develop the list of targeted communities, including the number of food stamps, the value of food stamps, interest/dividend income, personal income, and assessed valuation. A value was assigned to each of these topics and then these values were averaged to determine a score for each community. Those communities scoring in the lower 3/5 of the list would receive extra points when completing with other jurisdictions for annual CDBG program grants.

The State of Missouri intends to use this provision of our plan development schedule for communities with a population of 3,000 or less, not just those identified as being distressed or targeted, that have not already been included in a county's hazard mitigation plan. The factors upon which this decision was based include the following:

1. Based on the number of counties and other jurisdictions within the State, there is the potential requirement for developing 1,065 local hazard mitigation plans. It may be impractical to develop that many plans prior to the November 2004 deadline.

2. While recognizing the need for the plans, the State still must accept the reality of the situation and develop a workable solution that would address the needs of State and local government and still comply with what we believe to be the intent of the law.
3. Most of the communities of this size do not have the resources needed to independently develop a comprehensive local hazard mitigation plan.
4. Few of the communities of this size have participated (by their own choice) in the hazard mitigation grant program in the past.
5. Some of these communities will participate in the planning process as part of the development of their respective county hazard mitigation plan.
6. SEMA can assist those communities with the greatest need and/or potential first.

Based on the situation at the time, SEMA anticipates using PDM funding to develop additional local hazard mitigation plans, to include most Missouri jurisdictions by sometime in 2005. Should the State receive another presidential disaster declaration, SEMA would use available planning funds to complete additional local hazard mitigation plans, especially for counties sanctioned by the NFIP. SEMA, through the Regional Planning Commissions, will assist the identified jurisdictions in developing their local hazard mitigation plan. The SEMA Floodplain Management & Mitigation Assistance (FM&MA) Branch and the nine (9) Planner/Area Coordinators of the Planning & Disaster Recovery (P&DR) Branch will provide technical assistance as needed.

### **5.2.3 State Review of Local/Regional Mitigation Plans**

Approximately half of the jurisdictions within the State should have their local hazard mitigation plans completed before the FEMA deadline. This estimate is based on the extensive federal requirements for the hazard mitigation plans and the limited availability of personnel and funds at both the State and local levels. All local hazard mitigation plans will be developed in such a manner that they meet the federal plan requirements, address the specific hazard mitigation needs of the applicable jurisdictions, and complement the State Hazard Mitigation Plan.

The Disaster Mitigation Act of 2000 (Section 322(b)) lists the basic criteria for local mitigation plans. Those plans must describe actions to mitigate hazards, risks, and vulnerabilities identified under the plan; and establish a strategy to implement those actions.

FEMA has expanded on those criteria and established specific requirements for local mitigation plans. SEMA is working closely with the Regional Planning Commissions and local jurisdictions to ensure that their local hazard mitigation plans meet the established criteria.

Local hazard mitigation plans will undergo a continuous review during the development of the plan. As such, State/local officials and concerned members of the affected communities will be involved in the plan review process. This will help ensure that the plan is a document that works for the applicable jurisdiction and its citizens.

Upon completion of the local mitigation plan, it will be reviewed by the following branches within SEMA:

## **Planning & Disaster Recovery (P&DR) Branch**

- This review will usually be conducted by the applicable Area Coordinator. The Area Coordinator will review the plan for format and jurisdiction specific material.

## **Floodplain Management & Mitigation Assistance (FM&MA) Branch**

### *Mitigation Section*

- The assigned mitigation specialist will review the plan for compliance with the Disaster Mitigation Act of 2000, existing federal and State policies and regulations, and State priorities for mitigation. The plan will also be reviewed to ensure that it complements the State Hazard Mitigation Plan

### *Floodplain Management Section*

- The assigned specialist will review the plan to ensure compliance with existing federal, State, and local floodplain management regulations, policies, and ordinances.

As an option, depending on workload at the time the local hazard mitigation plans are completed, SEMA may elect to use contracted RPC planning personnel to perform the reviews.

Mitigation plan reviews will ensure that each local hazard mitigation plan meets the requirements of the Disaster Mitigation Act of 2000, complies with existing federal and State policies and regulations, and that the plan compliments the State Hazard Mitigation Plan and State priorities for mitigation.

It is understood by all levels of government that the success of the Missouri mitigation program will depend on the degree to which everyone works together toward a common goal. This is accomplished by involving as many interested groups as possible in the planning process. State mitigation staff will meet with each regional planning commission and jurisdictions as needed throughout the planning process. While there is no specific schedule for these meetings, they will occur:

- During scheduled public meetings;
- At the start of the planning process;
- At the mid-point of plan completion;
- At plan completion; and
- As requested by the regional planning commission and/or affected jurisdiction.

The state will use the information (hazard threat analysis, mitigation initiatives, public comments/concerns, etc) obtained from these meetings during the review/update process for the State Hazard Mitigation plan. This process would involve:

- Adding initiatives that have proved success at the local level.
- Researching development of mitigation initiatives that solve local concerns.
- Reviewing existing State initiatives to determine if they are still meeting the overall mitigation needs of the State.
- Changing or eliminating existing mitigation initiatives that have not produced the anticipated results.

The results of the meetings and reviews mentioned above would be incorporated into the State Hazard Mitigation Plan during the regular review/update process. Changes could be implemented sooner, depending on the circumstances involved. The results would also be disseminated to every jurisdiction with an existing mitigation plan for their review and/or incorporation into their local mitigation plan. This transfer of information would be accomplished through the use of existing SEMA websites, newsletters, EMD Bulletins, or other means as necessary.

Once the plan has gone through the review and coordination phase of its development and all recommended changes have been made, the plan will be provided to the applicable jurisdiction for approval. Since this is a Local Hazard Mitigation Plan, each affected jurisdiction must formally adopt the mitigation plan. This plan, once adopted, will be forwarded to SEMA for review. Upon completion of State review, SEMA will forward the local mitigation plan to FEMA for review. When the review process is complete, the applicable jurisdiction(s) will be notified of the acceptance of the plan or of any required changes that must be made.

Future mitigation projects and initiatives will be based on the jurisdictional plans. However, it is understood that funding, situations, and priorities change. Jurisdictions will be allowed the flexibility to add/subtract established mitigation projects as priorities, funding, and situations change. Because of this, the review process will be a vital part of the overall mitigation strategy for the State and local jurisdictions.

## **5.3 Prioritizing Local Assistance**

**Requirement 44 CFR §201.4(c)(4)(iii): The section shall include criteria for prioritizing communities and local jurisdictions that would receive planning and project grants under available funding programs which should include:**

*Consideration for communities with the highest risks,*

*Repetitive loss properties, and*

*Most intense development pressures.*

For non-planning grants, a principal criterion for prioritizing grants shall be the extent to which benefits are maximized according to a cost benefit review of proposed projects and their associated costs.

### **5.3.1 Prioritization of Communities /Jurisdictions for Planning Grants**

This section provides a description of the criteria by which the State will prioritize communities and local jurisdictions that would receive planning grants under the Hazard Mitigation Grant Program (HMGP), Flood Mitigation Assistance (FMA), Pre-Disaster Mitigation, and other available funding programs.

Federal and State funding for mitigation planning will be limited and in some instances may not be available. There will always be more requests for mitigation planning funds than there will be available funds. Approval of funds for mitigation planning will be based on the availability of funds and the determination as to whether the requesting jurisdiction has demonstrated the desire

and ability to complete the plan. Local jurisdictions should develop mitigation plans based on their unique capabilities and needs.

Since funding for mitigation planning grants is limited, those available funds must be distributed to those communities that have clearly demonstrated both the ability and the desire to complete the plan and to follow through with the initiatives developed in the plan. This desire to comply with the initiatives in the local mitigation plan should not be dependent on the availability of state or federal funds. In an effort to allow some flexibility in the distribution of mitigation planning funds the following general guidelines have been developed. These guidelines are not all inclusive and compliance with all of the issues listed below may not be required for approval of a planning grant.

1. The community must meet the criteria for the specific source of funds referenced in Section 5.1 (Funding Support).
2. SEMA will consider its past experience in dealing with the community on other grants (such as disaster grants, mitigation projects, etc.).
3. SEMA may contact the State Department of Economic Development (DED) Community Development Block Grant (CDBG) program, other State agencies/departments, and/or the local Regional Planning Commission (RPC) to check on their past experiences with the requesting community.
4. The State and local risk assessment will be reviewed to determine the susceptibility of the community to natural and human caused disasters.
5. SEMA will review previous presidential disaster declarations to determine the number of times the requesting community has been impacted by declared disasters and the magnitude of damages resulting from those disasters. This review would consider impact on community infrastructure, as well as families and businesses.
6. SEMA will also consider the number of non-declared disasters that have impacted the community. This review would consider impact on community infrastructure, as well as families and businesses.
7. SEMA will consider whether or not the community participates in the National Flood Insurance Program (NFIP).
8. SEMA will consider the number of insured, repetitive loss structures in the community.
9. SEMA will also consider the community's status as a small-impoverished community and communities with special developmental pressures, if applicable.
10. The community has identified natural disaster hazards in areas under its jurisdiction.
11. The community has demonstrated the ability to form effective public-private natural disaster hazard mitigation partnerships.

### **5.3.2 Administration of the Pre-Disaster Mitigation (PDM) Program**

SEMA will administer the Pre-Disaster Mitigation Program based on the requirements and guidelines established by FEMA under the Disaster Mitigation Act of 2000. The Mitigation Section of the Floodplain Management & Mitigation Assistance (FM&MA) Branch will have the

primary responsibility for implementing this program within the State. All jurisdictions are potential candidates for the pre-disaster mitigation program. Ideally, all communities would participate in some form of pre-disaster mitigation; however, due to differences in local capabilities and priorities, the degree of participation will vary greatly from community to community.

The pre-disaster mitigation program is designed to provide technical and financial assistance to State and local governments to assist in the implementation of pre-disaster hazard mitigation measures that are:

Cost-effective;

Designed to solve a problem to reduce injuries, loss of life, and damage or destruction of property (including damage to critical State or local government services and facilities; and

Complement current State and local mitigation goals and objectives.

Technical assistance will be primarily through the use of personnel from the State Emergency Management Agency (SEMA) mitigation section and the nine (9) Planner/Area Coordinators, and funding assistance will be based on the availability of funds through the programs mentioned in Section 5.1 (Funding Support).

The Disaster Mitigation Act of 2000 formally established the pre-disaster mitigation program. Under this program, the Governor of each State may recommend to the President not fewer than five (5) local governments to receive funding under this program. These State recommendations are made no later than October 1<sup>st</sup> of each year.

Funding for this program is determined by the U.S. Congress each year. As such, there may be times when there is no funding available for the program. Financial assistance under this program is provided with a federal cost share of up to 75% of the total cost of approved mitigation activities. Funds provided to communities shall be used principally to implement cost-effective pre-disaster mitigation measures. They may also be used to:

- Support effective public-private natural disaster hazard mitigation partnerships;
- Improve the assessment of a community's vulnerability to natural hazards; or
- Establish hazard mitigation priorities, and an appropriate hazard mitigation plan, for a community.

The State will use the criteria mentioned Section 5.2.2 to assist in determining which communities should receive technical and financial assistance under this program. In addition to those criteria, the State will also consider the basic Criteria for Assistance Awards established in the Disaster Mitigation Act of 2000. Those criteria are as follows:

1. The extent and nature of the hazards to be mitigated;
2. The degree of commitment of the local government to reduce damages from future natural disasters;
3. The degree of commitment of the local government to support the hazard mitigation measures to be carried out using the technical and financial assistance;

4. The extent to which the hazard mitigation measures to be carried out using the technical and financial assistance contribute to established State/Local mitigation goals and priorities;
5. The extent to which prioritized, cost-effective mitigation activities that produce meaningful and definable outcomes are clearly identified;
6. If the local government has submitted a mitigation plan, the extent to which the activities identified under paragraph (5) above are consistent with the mitigation plan;
7. The opportunity to fund activities that maximize net benefits to society; and
8. The extent to which assistance will fund activities in small impoverished communities.

#### Small and Impoverished Community Provisions

As used in pre-disaster mitigation, a small impoverished community means a community of 3,000 or fewer individuals that is economically disadvantaged, as determined by the State. Additional criteria may be determined by FEMA.

While the State does not maintain a list of communities specifically designated as small and impoverished, it does have communities that have been designated as distressed and targeted. SEMA has received assistance from the State Department of Economic Development Community Development Block Grant program in determining those communities that meet the criteria. These communities appear to meet the intent of the Disaster Mitigation Act of 2000's definition of small and impoverished. This issue is discussed in detail in Section 5.2 (Schedule for Development of Local Hazard Mitigation Plans).

The President may increase the federal cost share to 90% of the total cost of mitigation activities carried out by small impoverished communities; however, all other requirements will be the same as any other community participating in pre-disaster mitigation activities.

## **ALL COMMUNITY LISTING**

Attached at Appendix 1 is a listing of the counties and communities within the State of Missouri.

## **SMALL COMMUNITY LISTING (POPULATION OF 3,000 OR LESS)**

Attached at Appendix 2 is a listing of all communities within the State of Missouri with a population of 3,000 or less.



## 6.0 PLAN MAINTENANCE PROCESS

### 6.1 Monitoring, Evaluating, and Updating the Plan

**Requirement 44 CFR §201.4(c)(5)(i): The plan should detail the State’s established method and schedule for monitoring, evaluating, and updating the plan.**

The current Hazard Mitigation Plan is the result of the combined efforts of the State Hazard Mitigation Project Coordinating Group, State Emergency Management Agency, Federal Emergency Management Agency, Natural Resources Conservation Service (NRCS), U.S. Army Corps of Engineers, the National Weather Service, all nineteen (19) Regional Planning Commissions and/or Councils of Government in the State, local governments, electric cooperatives throughout the State, and concerned citizens. The plan was completed over the course of many years. Various state agencies and departments provided input regarding their own ongoing mitigation initiatives and other possible sources of funding for mitigation projects.

Mitigation and other staff members from FEMA Region VII and FEMA National Headquarters reviewed the State’s first draft mitigation plan against FEMA’s plan criteria. Their review and comments provided valuable information related to the content needed to meet the requirements of the Disaster Mitigation Act of 2000.

The Mitigation Section of the Floodplain Management & Mitigation Assistance (FM&MA) Branch within the State Emergency Management Agency is the lead group responsible for developing, reviewing, and updating the State Hazard Mitigation Plan. Meetings of the Hazard Mitigation Project Coordinating Group will be scheduled by the Disaster & Mitigation Assistance Branch as needed to review and update the State Hazard Mitigation Plan. These meetings will be conducted as a minimum:

- Upon receiving a presidential disaster declaration.
- As part of the State Hazard Mitigation Plan review/update every three (3) years.
- When required/needed due to changes in federal/state regulations and/or legislation that have an impact on the hazard mitigation program.

Hazard mitigation planning is a continuous and ongoing process. Policies & procedures established in this State of Missouri Hazard Mitigation Plan reflect the current emergency management and hazard mitigation philosophy at both the state and national level. Changes in hazard mitigation programs and/or priorities, including changes in legislation and available funding, may necessitate modifications to this plan.

In order to assess and incorporate necessary changes, an in house review and update of the State of Missouri Hazard Mitigation Plan will be conducted annually. This review will allow the State to direct its priorities in the appropriate manner prior to disasters. However, the review and update will be conducted more frequently, as needed, in the event of major disasters, including Presidential Disaster Declarations.

Goals and objectives will be reviewed as part of the regular plan review process. They will also be reviewed in conjunction with the review/approval process of local hazard mitigation plans. This will help ensure that the State and local hazard mitigation plans complement each other and that both State and local government are working together to accomplish the mitigation goals of the State of Missouri. Additionally, proposed mitigation projects will be reviewed to determine how they (mitigation projects) help state and local governments meet their established goals and objectives.

The following branches within the State of Emergency Management Agency and other State agencies and departments will participate in the development, review, and update of the State Hazard Mitigation Plan:

The SEMA Floodplain Management & Mitigation Assistance (FM&MA) Branch.

- The SEMA Planning & Disaster Recovery (P&DR) Branch.
- Members of the State Hazard Mitigation Project Coordinating Group.
- Other SEMA branches and/or State agencies and departments may be asked to assist in the review of this plan, based on legislative changes, FEMA policy changes, or State priorities affecting the State hazard mitigation program.

State agency participation includes, as a minimum:

- Review of hazard mitigation projects and initiatives to ensure there are no potential conflicts with ongoing agency initiatives.
- Review of hazard mitigation projects and initiatives to ensure they complement the statewide mitigation strategy.
- Review of existing State/federal programs to ensure that the State takes full advantage of possible funding sources in implementing the State Hazard Mitigation Program.

Public involvement in the hazard mitigation process will be accomplished through open public meetings as part of the development and review of local hazard mitigation plans. This process has already begun with the completion of nineteen public meetings hosted by Regional Planning Commissions/Councils of Government. State and local representatives will participate in these meetings and public input will be taken into consideration in developing mitigation priorities.

## **6.2 Monitoring Progress of Mitigation Activities**

**Requirement 44 CFR §201.4(c)(5) (ii) and (iii): The plan maintenance process should include:**

A system for monitoring implementation of mitigation measures and project closeouts, [and]

A system for reviewing progress on achieving goals as well as activities and projects in the Mitigation Strategy.

## **6.2.1 Monitoring Implementation of Mitigation Measures and Project Closeouts**

### **Project Management**

Upon notification from the FEMA that a project has been approved and is eligible for funding, the State Hazard Mitigation Officer (SHMO) will notify the subgrantee and will arrange a meeting to provide the subgrantee with appropriate information on Section 404 program requirements, State policy and grant management in accordance with 44 CFR 13. Materials provided to the subgrantee will include:

1. For buyout projects, A Local Officials Guide to Managing a Voluntary Buyout
2. 44 CFR Part 13 and 14
3. OMB Circulars A-87 and A-102

The State Emergency Management Agency is the grantee for project management and accountability of funds in accordance with 44 CFR 13. Approved applicants are considered subgrantees and as such are accountable to the grantee for funds awarded them.

### **Technical Assistance and Project Monitoring**

The State Emergency Management Agency (as grantee) recognizes the responsibilities laid out in 44 CFR 206.438(a): *The State serving as grantee has primary responsibility for project management and accountability of funds as indicated in 44 CFR part 13. The State is responsible for ensuring that subgrantees meet all program and administrative requirements.*

SEMA has made a commitment to monitor and provide technical assistance to all eligible and funded subgrantees. The SHMO, Project Manager, and/or Technical Support will attend subgrantee meetings to ensure the policies and procedures are explained correctly. Numerous worksheets, financial forms and targeted guidebooks for local officials have been developed by SEMA and have proven successful.

When necessary, a mitigation team member will attend the first closing of a buyout project to offer assistance in ensuring the necessary FEMA forms (e.g. Voluntary/URA, DOB Closing Statement) are completed.

Site visits, telephone conversations and facsimiles remain to be the best communication tools for the buyout program and any other mitigation project. Past mitigation successes reflect this, and thus, SEMA is confident the mechanisms outlined will ensure subgrantees success in administering the HMG program within Federal and State regulations and policies.

A modified Standard Form 270, Request for Advance or Reimbursement will be used by SEMA for processing fund requests. General principles for processing Requests for Funds are as follows:

1. Verify RFF is original (no facsimiles) and signed by authorized signor.
2. Verify spreadsheet Program Allocated and Administration Allocated columns are correct for the subgrantee.
3. Verify the Current Draw columns are correct.

4. Check for mathematical accuracy on the RFF.
5. Check for supporting documentation (property list, invoices, equipment and materials costs, etc.).
6. Verify all properties requested to be funded have DOB's released and SHPO clearance.
7. Enter amounts requested on spreadsheet.
8. Forward to Financial Department for processing.
9. Copy all documents to project file.

As a general rule, only 50 percent of administrative funds will be released prior to project closeout.

### **Cost Overruns**

For purposes of the mitigation buyout program, cost overruns are defined to be additional funds necessary to complete the mitigation project defined in the original HMGP Application submitted to FEMA for funding. Cost estimates for mitigation projects, such as acquisition and demolition costs for individual structure/lots, can be somewhat volatile. (NOTE: Property closings resulting in an overrun based on the estimate that can be offset by property closings resulting in a net underrun are not considered cost overruns for this purpose, and thus, do not need FEMA approval as outlined in 44 CFR 206.438(b)).

For acquisition projects, any properties added to the property list after initial submission to FEMA will require SEMA and FEMA approval. If add-on properties can be acquired with original grant allocations, again, this will not be considered an overrun. Adjustments to budget line items based on the HMGP Buyout Application do not need SEMA approval.

Immediately upon recognition that an original scope of work approved and funded cannot be accomplished with the grant funds allocated, the grant administrator, through the authorized representative of the subgrantee, must submit a request for additional funds with appropriate justification documents to the Governor's Authorized Representative (GAR).

Upon receipt, the GAR will review the documents and make a determination. If the request is justifiable, the GAR will forward the request with the State's recommendation to the FEMA Regional Director. If the request is not justifiable, the GAR will deny the request. In no case will the total amount obligated to the State exceed the funding limits set forth in 44 CFR 206.432(b).

### **Appeals**

All subgrantee appeals to FEMA decisions will be administered in accordance with 44 CFR 206.440.

### **Quarterly Reports**

Quarterly Reports based on a calendar year will be provided to the FEMA Region VII Director as required by 44 CFR 206.438(c).

## **Environmental and Floodplain Management Reviews**

SEMA will generally refer any needs for environmental reviews or environmental impact statements to MoDOT.

1. SEMA mitigation staff will provide the necessary project information to MoDOT.
2. MoDOT will complete the necessary reports for SEMA based on an established memorandum of understanding.
3. SEMA will then forward the report to FEMA for review and approval.

The Missouri Floodplain Management program was transferred to SEMA from the Department of Natural Resources on January 1, 1995. This transfer provides SEMA's hazard mitigation section a direct link with trained floodplain managers and engineers.

All mitigation projects, to include projects funded to remove structures from the floodplains, are forwarded to SEMA's Floodplain Management Section for review and comment. After a subgrantee has completed a buyout project and the grant is closed a list of properties acquired will be provided to the Floodplain Manager Section for use when conducting community assistance visits (CAVs) with the FEMA Floodplain Department.

## General Compliance Assurance Statement

Because of inherent limitations in any grant management program, errors may occur; however, as referenced throughout this Plan, it is SEMA's intent to comply with all administrative requirements outlined in 44 CFR Parts 13 and 206 in their entirety and to monitor all subgrant supported activities to ensure compliance with 44 CFR Parts 13 and 206 in their entirety.

## Project Closeout

Upon completion of a hazard mitigation grant project, the Program Manager and/or Hazard Mitigation Grant Auditor will conduct a closeout site visit to review all files (or a representative sample) and all documents pertaining to the use of 404 and State General Revenue funds. In addition, all procurement files and contracts to third parties will be reviewed. Worksheets have been created to aid in the closeout review.

All reports generated at the closeout site visit are compared with Request for Funds submitted throughout the duration of the program. Any significant findings are reported to the SHMO for final determination in corrective action. Corrective Action notices will be sent to subgrantees and another site visit will be conducted, if necessary, prior to the release of remaining administrative funds.

Closeout reports will be submitted for each subgrantee upon expiration of the grant. The closeout report will summarize the following:

- Grant application and approval award
- Procurement
- State Historical Preservation Office
- Use of administrative allowance
- Final list of properties acquired, if a buyout project
- Summary of costs incurred

- Verification of project monitoring and correspondence
- Demolition (open space), if a buyout project
- Certificate of Completion

Closeout reports will be submitted 90 days after notification by quarterly report that a project has been completed, to include demolition (if applicable).

### **Audit Requirements**

44 CFR 14, *Administration of Grants: Audits of State and Local Governments*, requires all subgrantees receiving \$300,000 (\$500,000 after December 31, 2003) or more in Federal assistance to have an audit conducted in accordance with the Single Audit Act. Such reports by an independent Certified Public Accountant will be maintained by SEMA. All general audit requirements in 44 CFR Part 14 will be adhered to by SEMA as well as subgrantees receiving FEMA hazard mitigation grant awards.

## **6.2.2 Progress Review for Mitigation Goals and Objectives**

In order for any program to remain effective, the goals and objectives of that program must be reviewed periodically. That review should address, as a minimum, the following issues:

1. Are the established goals and objectives realistic? Take into consideration available funding, staffing, and state/local capabilities, and the overall State mitigation strategy.
2. Has the State clearly explained the overall mitigation strategy to local governments?
3. Are proposed mitigation projects evaluated based on how they help the State and/or local government meet their overall mitigation goals and objectives?
4. How have approved mitigation projects complemented existing State and/or local government mitigation goals and objectives?
5. Have completed mitigation projects generated the anticipated cost avoidance or other disaster reduction result?

A thorough and realistic evaluation of the benefits of a mitigation project may be delayed until the area of the project is impacted by another disaster. The lack of realized benefits from a completed mitigation project may result in the disapproval or modification of similar projects in the future. At the same time, mitigation projects that have proven their worth may be repeated in other areas of the State.

Based on the results of the review/evaluation mentioned above, the State may need to adjust its goals and objectives to meet the current and future mitigation needs of the State and local governments. A formal mitigation status report will be prepared by the SEMA Floodplain Management & Mitigation Assistance Branch on an annual basis. This report will be provided to the SEMA Director and Deputy Director for review and distribution, as needed. The report will address, as a minimum, the following items:

1. Completed mitigation projects
  - a. Affected jurisdiction
  - b. Brief description of the project
  - c. Source of funding

- d. Brief summary of any problem areas, with proposed solution
  - e. Brief summary of effectiveness (cost-avoidance) of project, if available
- 2. Mitigation projects in progress
    - a. Affected jurisdiction
    - b. Brief description of the project
    - c. Source of funding
    - d. Brief summary of project status
    - e. Anticipated completion date
  - 3. Pending (under review) mitigation projects
    - a. Affected jurisdiction
    - b. Brief description of the project
    - c. Source of funding
    - d. Brief summary of project status

### **6.2.3 State Agency Responsibilities**

State agencies will need to work together to complete the program/project management and plan review activities listed in previous sections.

#### **State Emergency Management Agency (SEMA)**

SEMA will hire temporary employees as needed to support hazard mitigation initiatives, but in general will manage hazard mitigation programs through the work of the Floodplain Management & Mitigation Assistance (FM&MA) Branch.

The Mitigation Management Section will:

- 1. Administer and supervise the State Hazard Mitigation Program.
- 2. Serve as lead agency on the State Hazard Mitigation Project Coordinating Group.
- 3. Serve as the lead agency for the coordination, development, review, and updates of the State Hazard Mitigation Plan.
- 4. Publicize hazard mitigation program availability.
- 5. Educate potential applicants on the hazard mitigation program and potential hazard mitigation opportunities.
- 6. Establish priorities for use of available mitigation funds.
- 7. Review hazard mitigation projects for compliance with established State mitigation goals and objectives.
- 8. Review hazard mitigation projects for cost-effectiveness.

The Floodplain Management Section will:

- 1. Provide technical assistance/personnel to resolve National Flood Insurance Program (NFIP) issues.

2. Provide and/or interpret floodplain maps, as needed, to resolve issues concerning applicability of NFIP regulations.
3. Determine community NFIP participation.
4. Promote NFIP participation.

#### **Missouri Department Of Transportation (MODOT)**

1. Provide technical assistance as needed to resolve hazard mitigation related issues.
2. Provide technical assistance concerning environmental studies and environmental impact statements relating to the National Environmental Policy Act (NEPA).
3. Review mitigation projects for potential conflict with current or future highway projects.
4. Participate in the Hazard Mitigation Project Coordinating Group.

#### **Department of Natural Resources (DNR)**

1. Provide technical assistance to State hazard mitigation personnel concerning DNR related issues.
2. Provide technical assistance to State hazard mitigation personnel concerning historic preservation related issues.
3. Participate in the Hazard Mitigation Project Coordinating Group.

#### **Office of Administration (OA)**

1. Process vouchers and issue checks for eligible hazard mitigation applicants/projects based on warrant requests provided by the SEMA fiscal branch. (Division of Accounting).
2. Maintain financial records (Division of Accounting).
3. Provide technical assistance to resolve hazard mitigation related issues, as needed and available. (Design and Construction)



**State Auditor**

1. Perform audits as required by applicable laws and regulations. Forward copies of those audits to the SEMA hazard mitigation staff.
2. Provide documentation guidance to applicants, as needed.

**Division of Insurance**

1. Provide technical assistance regarding problems encountered with insurance companies during disaster situations (specifically Increased Cost of Compliance issues).
2. Provide advice regarding insurance rules and regulations.

**Department of Conservation**

1. Provide technical assistance to State hazard mitigation personnel concerning conservation related issues.
2. Provide technical assistance to State hazard mitigation personnel concerning endangered species related issues.
3. Coordinate or assist, on a case-by-case basis, on hazard mitigation projects.

**Department of Labor and Industrial Relations**

1. Through the Division of Labor Standards, provide information on Missouri Labor Standards.
2. Provide personnel, as needed, to assist and educate State and local hazard mitigation staff on Missouri Prevailing Wage and Child Labor Laws.

**Department of Economic Development (DED)**

1. Provide technical assistance to State hazard mitigation personnel concerning DED related issues.
2. Coordinate potential availability of Community Development Block Grant (CDBG) funds to assist the State and local hazard mitigation staff with mitigation projects.
3. Provide information related to small impoverished community status.
4. Participate in the Hazard Mitigation Project Coordinating Group.

**6.2.4 Staffing**

In addition to the duties of the State Hazard Mitigation Project Coordinating Group, SEMA will implement the State Plan and administer the mitigation programs utilizing the following positions:

**State Hazard Mitigation Officer (SHMO)**

The Governor's Authorized Representative (GAR) designates the SHMO. The SHMO has overall management responsibility for the program and is the state official who is ultimately responsible for ensuring that the state properly carries out its Section 404 and Section 409 responsibilities subsequent to a Presidential Disaster Declaration. In this regard, the SHMO will

monitor the activities of the Project Manager and the State Hazard Mitigation Team. Responsibilities include, but are not limited to:

1. Ensure the Administrative Plan is updated, outlining how the state will administer the Hazard Mitigation Grant Program.
2. Ensure that the Missouri Hazard Mitigation Plan is active and identifies potential hazard mitigation projects, as well as establish priorities among those projects.
3. Ensure that all potential applicants are notified of the program and receive the assistance to which they are entitled.
4. Ensure that a proper initial application and any necessary supplemental applications, including SF-424's, are submitted in a timely fashion to the FEMA Regional Director.
5. Ensure that technical assistance is provided to potential applicants and/or eligible subgrantees.
6. Ensure that adequate procedures are developed for the distribution of financial assistance to eligible subgrantees by the technical assistance staff.
7. Ensure development of a system to monitor completion of approved projects in federally required time frames.
8. Ensure that a system exists to monitor subgrantee accounting systems and compliance with 44 CFR parts 13 and 14.
9. Ensure that appropriate state agencies are on the State Hazard Mitigation Team and are involved as necessary with the hazard mitigation process.
10. Ensure that Section 409 requirements, including development of the "180 day" plan, are met and closely tied to administration of the Section 404 Grant Program.
11. Ensure participation of the appropriate local agencies in the administration and implementation of the Section 404 and 409 Programs. This may include the appointment of a local Hazard Mitigation Officer.
12. Coordinate with the GAR on all policy/regulatory issues. Review and make appropriate recommendation to GAR regarding appeals, cost overruns/underruns and all other program issues.

### **Program/Project Manager**

The Program/Project Manager is responsible for program coordination, implementation and administration. The manager will accomplish the necessary program work required of the State to deliver the Hazard Mitigation Grant Program to eligible subgrantees. In addition to assisting the Project Director in all aspects of mitigation, the project manager's responsibilities include, but are not limited to:

1. Develop the Administrative Plan which outlines how the State will administer the Section 404 Hazard Mitigation Grant Program and implement the plan in a Presidential Disaster Declaration.
2. Develop and implement a process for identifying potential hazard mitigation projects and for setting priorities among those projects.

3. Maintain a computer management system for hazard mitigation activities and products. Maintain computer files for grant and sub-grant activities, or ensure that the technical support is maintaining such computer files.
4. Coordinate with the Federal Hazard Mitigation Officer in determining the composition of the Interagency Hazard Mitigation Team or Hazard Mitigation Survey Team and its schedule of activities, in estimating the amount of FEMA money available for the Section 404 program, and in administering the program, including submitting required reports to the FEMA.
5. Notify potential applicants of the program and brief them, with appropriate handout material on elements of the program.
6. Coordinate with Federal, State and local officials to ensure that they understand the involvement of the Hazard Mitigation effort in the Public Assistance program.
7. Prepare and submit the initial Hazard Mitigation Grant Program (HMGP) or Pre-Disaster Mitigation (PDM) application and any supplemental applications as required by federal regulations.
8. Provide technical assistance to potential applicants and/or eligible subgrantees in developing and submitting applications and in completing projects.
9. Implement departmental procedures to monitor the status of approved projects, for processing extension requests and appeals, and for closing out completed projects.
10. Coordinate with the technical support staff in monitoring subgrantee accounting systems to meet requirements of Code of Federal Regulations (CFR) 44 Part 13 and Part 14.
11. Help update the Section 409 Hazard Mitigation Plan and interface as required and appropriate with administration of the Section 404 Hazard Mitigation Grant Program.
12. Coordinate with the Missouri SEMA Fiscal Office procedures to manage:
  - Letters of credit, including performing financial disbursements and financial revision, processing the final payments, initiating requests to decrease and close out the letters of credit and close out the account and process bills for collection.
  - Process state checks to subgrantees and enter disbursements into state financial management system.
  - Maintain financial records of all disbursements to subgrantees and prepare fiscal documents for processing the final claim, process the final state payment, close the files and prepare the closeout report.
13. Maintain records of administrative expenses and state management costs eligible for reimbursement as provided for in FEMA regulations.
14. Conduct site visits to monitor progress and provide technical assistance.
15. Assist the SHMO in conducting mitigation conferences and or public meetings.
16. Prepare Quarterly Reports as needed.

### **Mitigation Specialist**

A mitigation specialist is responsible for the planning, promotion, direction and evaluation of mitigation and floodplain management issues. Work involves advising and assisting the Director and SHMO in a statewide program and normally involves frequent contacts with state and local officials, public agencies, community and civic groups etc. Duties also include conducting special studies and surveys and planning and participating in workshops, conferences and test exercises. Other duties include, but are not limited to:

1. Supervise, plan and conduct special studies and surveys necessary for the organization, planning and evaluation of floodplain management activities including hazard mitigation.
2. Advise and assist local officials on floodplain management matters; interpret and explain federal requirements and procedures; maintain liaison with federal representatives on floodplain management matters.
3. Plan and participate in floodplain management training, workshops, conferences and test exercises, particularly in those program areas in which responsibility is delegated.
4. Make public appearances before civic and community groups to promote the floodplain management program.
5. Correspond with local officials, government agencies; federal floodplain management representatives, etc. prepare reports as required.
6. Assist local communities throughout the state in preparation of ordinances, pamphlets, training and education documents and various planning reports.
7. Travel extensively throughout the state to conduct community assistance visits and make community assessments.
8. Review ordinances for compliance with federal and state regulations.

### **Technical Support**

A technical support staff member is responsible for assisting the SHMO, Program Manager(s), and Mitigation Specialist(s) in all aspects of administration of the mitigation program. In addition, this is professional work involving program and financial reviews of subgrantees. Examples of work performed in addition to assisting both the project director and manager include, but are not limited to:

1. Conduct on-site reviews of subgrantee program operations and activities and financial records and report significant findings.
2. Review and examine vendor uses to determine adequacy of services and compliance with state and federal rules, regulations and procedures.
3. Perform budget reviews to determine cost/service appropriateness of each item and proper cost of each budget category.
4. Examine documents to determine that expenditures are charged against correct appropriation accounts and that expenditures fall within the intent of the appropriation, the law, and are in the form in which the account was established.
5. Gather, reconcile and prepare financial and program data pertaining to budgetary control, state and federal cost reports, personnel services and non-appropriated funds.

6. Examine expenditures for propriety and reasonableness.
7. Compose correspondence as necessary for areas of responsibility.
8. Review current federal and state regulations concerning mitigation programs so as to maintain currency of knowledge and standards that are necessary to the performance of subgrantee review.
9. Provide technical assistance to subgrantees through site visits, written correspondence and telephonic means.
9. Explain to subgrantees the purpose of and the procedures and obligations involved in a review.

### **Clerical Support**

The clerk typist performs skilled typing and complex clerical work. The work involves skilled typing of a variety of materials in final form and responsibility for format, charts and tables. The clerk provides secretarial services for mitigation staff. Work involves making independent decisions concerning the procedure or process to be followed and the actions to be taken. Examples of tasks performed include, but are not limited to:

1. Supervise and participate in the receipt and processing of correspondence; the preparation, coding and typing of personnel, purchasing, supply, financial and other documents; and the checking and posting of program transactions.
2. Organize work and coordinate workflow; establish priorities, set deadlines and review work for adequacy, accuracy, timeliness and conformance with instructions and standard practice.
3. Receive visitors and answer calls, ascertain the purpose of calls and visits, and furnish information from knowledge of agency policies, rules and procedures.
4. Perform a variety of supportive secretarial duties for administrative staff.
5. Establish and maintain files for the unit.
6. Make appointments and arrange travel and accommodations; maintain confidential files.
7. Receive, open, log, sort and distribute mail; compose and/or type letters in reply; supervise the dispatch of outgoing mail.
8. Compose and type correspondence and inter-office mail.
9. Prepare and type a variety of material which includes standardized and statistical reports that involve selection and verification of data and establishment of appropriate format.
10. Order supplies, maintain equipment and supply inventory.
11. Operate standard office equipment.

If the size of the disaster or the number of mitigation projects is beyond the capability of the assigned mitigation staff to effectively handle, other Branch and/or SEMA personnel may be called upon to assist the mitigation section. Another source of mitigation staff support would be through the use of the Emergency Management Assistance Compact (EMAC).

## **7.0 ENHANCED PLAN**

### **7.1 Project Implementation**

**Requirement 44 CFR §201.5(b)(2) (i) and (ii): The Enhanced Plan must document the State's project implementation capability, identifying and demonstrating the ability to implement the plan, including:**

Established eligibility criteria for multi-hazard mitigation measures, and

A system to determine the cost effectiveness of mitigation measures, consistent with OMB Circular A-94, Guidelines and Discount Rates for Benefit-Cost Analysis of Federal Programs, and to rank the measures according to the State's eligibility criteria.

#### **7.1.1 Process Used to Evaluate and Prioritize Mitigation Actions**

Local jurisdictions are strongly encouraged to incorporate mitigation initiatives, based on established natural hazard risk assessments, into all proposed development projects and as improvements to existing projects. To varying degrees this has been established as a part of project development and approval.

Funding will always be an important issue when considering mitigation actions. State and federal mitigation funds are limited. Generally these funds are only available as the result of declared disasters. As such, a process has been developed to evaluate and prioritize proposed mitigation actions.

The Hazard Mitigation Project Coordination Group, with SEMA as the lead agency, has the primary responsibility for reviewing and evaluating mitigation projects submitted by local jurisdictions. The following issues will be reviewed and discussed as part of the process used to evaluate and prioritize mitigation projects:

1. The jurisdiction that submitted the mitigation proposal must have an approval local hazard mitigation plan on file. Jurisdictions with a population of less than 3,000 that do not have an approved hazard mitigation plan on file must have the capability and desire to complete a plan within twelve months of project approval.
2. The project must be in conformance with the jurisdiction's approved hazard mitigation plan. Since situations and priorities change over time, projects that are not in the jurisdictions mitigation plan may still be approved, if they meet all other mitigation project eligibility requirements.
3. The project must solve a problem independently or constitute a functional portion of a solution where there is assurance that the project as a whole will be completed.
4. The project must be cost-effective and substantially reduce the risk of future damage, hardship, loss, or suffering resulting from a major disaster.
5. The hazard being mitigated will be checked against the current risk assessment as outlined in the jurisdictions approved local hazard mitigation plan.

6. While not a specific requirement, priority will be given to those projects located within the declared disaster area.
7. A review of mitigation efforts undertaken by the jurisdiction using local funds and initiatives.
8. A review of the disaster history of the jurisdiction.
9. Availability of matching funds from the state and/or local jurisdiction.

This plan does not differentiate or classify mitigation initiatives as primary or alternates. Mitigation initiatives will be evaluated and prioritized based on the criteria described above. Any mitigation project that is approved for funding is done so on the basis that it will benefit the community at large and therefore the State.

State of Missouri project priorities consider hazards, risk, vulnerability and capabilities. Flood buyout projects (especially for repetitive loss properties), other flood mitigation and structural projects to protect essential infrastructure are the State's highest priority. Projects to protect individuals from tornadoes and high wind rank second. This is followed by projects to reduce losses from earthquake.

### **7.1.2 Eligibility Criteria for Multi-Hazard Mitigation Projects**

This section of the State Hazard Mitigation Plan addresses the eligibility criteria for multi-hazard mitigation projects. The criteria listed in this section of the plan are the basic criteria for each type of project. These criteria may be modified based on any of the following issues:

- The specific disaster situation;
- Location of affected areas;
- Availability of funds;
- Unique program requirements of the fund source;
- Current State and/or local hazard mitigation priorities; and
- Number/type of mitigation projects submitted by local governments.

All hazard mitigation projects submitted for consideration must meet the criteria outlined in Code of Federal Regulations (CFR) 44, Section 206.434. There may be additional requirements established by the State that must be met before a project would be considered for approval.

To meet FEMA's Minimum Hazard Mitigation Project Criteria, the project must:

1. Be in conformance with the hazard mitigation plan developed as a requirement of Section 409;
2. Have a beneficial impact upon the designated disaster area, whether or not located in the designated area;
3. Be in conformance with 44 CFR part 9, Floodplain Management and Protection of Wetlands, and 44 CFR part 10, Environmental Considerations;

4. Solve a problem independently or constitute a functional portion of a solution where there is assurance that the project as a whole will be completed. Projects that merely identify or analyze hazards or problems are not eligible; and
5. Be cost-effective and substantially reduce the risk of future damage, hardship, loss, or suffering resulting from a major disaster.

The project must also meet the following State criteria:

1. The project must complement existing or proposed State mitigation goals and objectives;
2. The project must complement existing or proposed mitigation goals and objects for the jurisdiction submitting the project;
3. The jurisdiction requesting the project must be able to complete the project as submitted;
4. The jurisdiction submitting the project must be able to meet any matching funds requirements (if required).
5. The project must be able to make a bigger impact on the local and state mitigation program than other non-selected projects.

While buyouts are not the only mitigation projects considered and undertaken by the State and local governments, they have been the type of project most frequently submitted and approved. In general, SEMA works with local governmental entities to acquire and remove, elevate, relocate or perform minor structural projects only on privately owned residential structures and/or privately owned lots that are located in the floodplain and/or floodway. In addition to the requirements listed above, these projects must also meet the following criteria:

1. The project chosen must independently solve or be a functional part of a solution to a problem that is repetitive or poses a significant risk to health and safety. The proposed solution must be the most practical, effective, cost-effective and environmentally sound alternative among a range of alternatives that contribute to a long-term solution of the problem.
2. Local governmental entities (or certain private non-profit entities) must apply through the State, specifically SEMA, to FEMA for approval to perform a project or projects. The applications must specifically identify the properties to be included in the project or projects. All projects must be proven cost-beneficial, in accordance with a determination method that is acceptable to SEMA/FEMA. This is usually accomplished by using the FEMA benefit cost analysis module.
3. Local governmental/non-profit entities must be in good standing in the NFIP (or have not yet been mapped), and otherwise eligible to receive federal funding. Non-federal matches and all other federal grant requirements must be satisfied by the local entity, sometimes with the monetary assistance of local property owners or possibly with assistance from SEMA or CDBG.
4. Hazard Mitigation Grant Program, Pre-Disaster Mitigation (PDM) and Flood Mitigation Assistance (FMA) projects must be consistent with the overall State Hazard Mitigation Plan. Projects also must conform to the to 44 CFR Part 9, Floodplain Management and Protection of Wetlands, and 44 CFR Part 10, Environmental Considerations.



5. Only local governmental/non-profit entities may manage the project or projects. All projects must be managed in accordance with local, state and federal ordinances, laws and regulations. Individual property owners are not eligible to receive federal funds directly as a grantee or sub-grantee and are not authorized to manage grant projects.

### **7.1.3 Eligibility Criteria by Mitigation Project Type**

SEMA considers a number of types of projects to be eligible for mitigation, with flood mitigation projects the highest priority. In each type of project below, the sellers' participation must be **voluntary** and the sellers must be able to prove ownership of the property involved in the project. The below eligibility criteria applies:

#### **Property Acquisition**

This is SEMA's most favored, and usually most cost effective, voluntary option because the people and property are totally and permanently removed from the path of flooding and danger. To be eligible to participate, the local governmental/non-profit entity must agree to the following:

1. Offer is based on pre-flood fair market value determined by a State of Missouri board certified appraiser or a post-flood sales contract value.
2. Duplication of Benefits (DOB), Small Business Administration (SBA) loans and private mortgages must be satisfied from proceeds first.
3. The buyout property must be demolished within 90 days of the closing.
4. Local governmental entities, or certain non-profit entities, must accept all buyout property titles that are officially annotated to comply (in perpetuity) with federal Open Space deed restrictions.
5. The buyout property becomes ineligible for any future federal disaster assistance, except possibly Federal Crop Insurance.

#### **Elevation**

This voluntary option may be used in the event it generally is more cost-effective and desirable over the long term, for example, when the cost of the land is so high that a buyout is impractical. To be eligible to participate, the local governmental/ non-profit entity must agree to the following:

1. Elevation project must be a practical, cost-effective and structurally sound alternative (in compliance with local building code and zoning rules) that elevates the lowest floor at or above the flood level or in compliance with local governmental entity floodplain management, if more stringent, by:
  - Extending the walls of the house upward and raises the lowest floor; or
  - Converting the existing lower area of the house to non-habitable space and builds a new second story for living space; or
  - Lifting the entire house, with the floor slab attached, and builds a new foundation to elevate the house.

2. In A zones, where flood hazards are less severe, property owners may elect to elevate buildings either on an open foundation or on continuous foundation walls that extend below the Base Flood Elevation (BFE). If continuous walls are used below the BFE, they must be equipped with openings that allow floodwaters to flow into and out of the area enclosed by the walls.
3. Owners of substantially damaged houses in Special Flood Hazard Areas must be willing to voluntarily demolish the remnants of the house and build a new house on the same site with an elevated lowest floor at or above the flood level or in compliance with local governmental entity floodplain management rules, if more stringent.
4. As an alternative, owners of substantially damaged houses in Special Flood Hazard Areas may elect to repair the house and elevate the lowest floor at or above the flood level or in compliance with local governmental entity floodplain management rules, if more stringent, as part of the repair process.

### **Relocation**

This voluntary option may be used if it is more practical/cost effective or when the threat is so repetitive and/or severe that it is more advantageous to relocate a structure or structures, up to and including entire communities entirely out of harms way. To be eligible to participate, the local governmental/non-profit entity must agree to the following:

1. Structures relocated from acquired property must be placed entirely outside the 100-year floodplain.
2. Structures generally must be relocated from acquired property within 90 days of closing.
3. Ownership of acquired property may not be conveyed to private citizens or entities; ownership may be conveyed to other public entities or nonprofit organizations with the approval of the State and FEMA.
4. Local governmental entities, or certain non-profit entities, must accept any buyout property titles that are officially annotated to comply (in perpetuity) with federal Open Space deed restrictions.
5. Any buyout property (i.e., any vacated lots acquired through the project) becomes ineligible for any future federal disaster assistance, except possibly Federal Crop Insurance.

### **Floodproofing**

This voluntary option may be most practical in limited danger areas. To be eligible to participate, the local governmental/non-profit entity must agree that this measure will best resolve the danger to the property:

1. The property is in an area that is not subject to flash flooding.
2. Extensive cleanup normally is not required after a flood event.
3. One of the two floodproofing processes described below is the most advantageous measure to employ over the long term.

***Wet floodproofing*** allows water to enter the structure, thereby equalizing pressure on walls and floors. Building contents such as furnaces and appliances are relocated out of reach of the floodwater.

**Dry floodproofing** is a process that uses waterproofing compounds, sheeting or other impermeable materials to prevent floodwaters from entering the structure.

### **Structural Mitigation Projects**

This option applies to infrastructure type mitigation projects associated with the Public Assistance (PA) program. To be eligible to participate, the jurisdiction must meet all of the eligibility criteria of the federal/state public assistance program. Those criteria include, but are not limited to, the following:

1. The project is required as a result of the declared event.
2. The project is within the designated disaster area.
3. The project is the legal responsibility of an eligible applicant.

### **Tornado Safe Rooms**

In addition to the requirements for flood mitigation projects, projects to protect people from tornadoes and high winds must also comply with FEMA Publications 320 and 361.

### **Other Mitigation Projects**

The majority of Missouri's approved mitigation projects have been generated by flood related disasters. Other projects shown below also may be approved depending on the availability of funds, state and local priorities, proof of cost-benefit and project submissions:

- Tornado safe-rooms
- Structural seismic retrofit of non-damaged critical facilities
- Non-structural seismic retrofit of non-damaged critical facilities (such as filming windows, strapping and bracing equipment, etc.)
- Development of educational programs and materials
- 5% State Initiative Projects

## **7.1.4 Cost-Effectiveness of Mitigation Measures**

A key criterion for mitigation projects to be eligible for funding is that they must be cost-effective. If the project benefits are higher than the project costs, then the project is cost-effective. The purpose of this section is to address the process used by the State to determine the cost-effectiveness of mitigation measures and how those mitigation measures are ranked according to the eligibility criteria.

In order to insure a consistent approach in determining the cost-effectiveness of all mitigation projects, the State will use the FEMA Benefit Cost Analysis (BCA) module and process. Since this is also the method used by FEMA to determine the cost-effectiveness of a project, it is only reasonable that the State use the same method. The benefit cost analysis (BCA) is an assessment of the mitigation project application data to determine whether the cost of investing federal/state/local funds in a hazard mitigation project is justified by the prevented or reduced damages from future disasters. With limited project data and streamlined benefit-cost methods, a cost-effectiveness determination can usually be made quickly and accurately.

It is understood that a positive benefit cost ratio (greater than one) does not necessarily guarantee that a hazard mitigation project will be approved. However, by applying project specific

information to the benefit cost analysis module we can get a good initial look at the mitigation potentials associated with that project. The results of this analysis can also help communities evaluate current and future mitigation projects and adjust their overall mitigation strategy accordingly.

The following information serves to summarize the three-step process of determining a mitigation project's cost-effectiveness. This process is used for determining the cost-effectiveness of all mitigation project applications regardless of the type of mitigation measure.

### **Screen Project Application Data**

The first part of the process is screening the project application to gather data relating to cost-effectiveness. This includes economic, environmental, and engineering data. Often, this data is missing or limited. The amount of data available will determine the type of benefit cost analysis you use. The screening process involves three separate but related tasks. Each task is conducted simultaneously and is essential to developing an overall profile of the project before conducting the benefit cost analysis.

1. Engineering Review - This review establishes whether the project is feasible from an engineering standpoint and whether it will reduce damages as claimed. The reviewer may suggest changes to make the project more efficient in reducing damage and loss.
2. Environmental Assessment - This part of the screening process alerts reviewers to any potential environmental concerns raised by the project.
3. Project Application Data - This part of the screening process determines whether the application contains sufficient information and data for input into the benefit-cost model. (See Table 1)

Ideally, the project application would contain all the data needed. However, project applications often have incomplete or limited data. This is one of the main reasons that a streamlined process was developed to determine project cost-effectiveness without all the data. It is also the reason that federal, state, and local mitigation specialists must work closely together to ensure that all proposed mitigation projects are thoroughly reviewed and comply with the mitigation goals and objectives. Rather than require additional information - which may or may not be available and which can cost valuable time and money - FEMA devised shortcuts. With these shortcuts, additional data does not necessarily need to be collected in order to do a benefit cost analysis. Screening the project data will assist in determining which type of analysis to perform.

There is basic data (See **Table 50**) that must be obtained from hazard mitigation applications before a benefit cost analysis can be performed. This data is plugged-in to the benefit cost module to assess whether the project is cost-effective or not. While the table addresses flood and earthquake project applications, the same basic "subject data" information and analysis is needed for mitigation projects related to any type of hazard. The following are examples of key data that are typically used for analyzing flood and earthquake hazard mitigation projects:

**Table 50. Key Data Needed for Analyzing Project Applications**

Subject	Flood Project Data	Earthquake Project Data
Hazard Data (often not included in application)	Flood Insurance Study (FIS) data, or historical flood data from application	Seismic hazard data from a credible source
First Floor Elevation	Is this available from engineering surveys or can it be estimated from observed flood depths?	Not applicable
Scope	What problem does the project address? How vulnerable is the building, item, or area?	Same as flood
Cost	Is there a well-documented cost-estimate or only a rough estimate?	Same as flood
Useful Lifetime	How long will the project provide protection (mitigation) against damages and losses?	Same as flood
Economic Considerations	What is the square footage of the building? What are the replacement values of the building (or other facility) and contents?	Same as flood
Occupancy	Not usually applicable	What are the levels of occupancy and visitors during various times throughout the day?
Function	What is the function of the facility and is it entirely or partially related to emergency response and recovery?	Same as flood
Damage Estimates - Before Mitigation	1. What type of building it is, or 2. Why do damages occur? 3. What are the historically-observed damages?	1. Same as flood 2. Are engineering reports available that describe building/ facility's seismic vulnerabilities?
Damage Estimates - After Mitigation	How effective will the mitigation project be in reducing future damages? (Reduced damages can be percent or dollar values)	Same as flood

### Benefit Cost Analysis

The second part of the process is to determine which benefit cost analysis tool to use. If the project application data are limited or incomplete, then a benefit cost analysis that uses limited data should be employed. If, however, the data in the project application are more or less complete, then a more robust method of analysis can be used.

Benefit cost analysis is used for all cost-effectiveness determinations. Although the following sample analysis is an oversimplification, the concepts it illustrates are important. At its most basic level, benefit cost analysis determines whether the cost of investing in a mitigation project today (the "cost") will result in sufficiently reduced damages in the future (the "benefits") to justify spending money on the project. If the benefit is greater than the cost, then the project is cost-effective; if the benefit is less than the cost, then the project is not cost-effective. This analysis provides an example of the kind of comparative benefit and cost data you might see after conducting a benefit cost analysis.

It is important to understand that benefit cost analysis is basically the same for each type of hazard mitigation project. The only differences are the types of data that are used in the calculations, depending on whether the project is for floods or earthquakes.

1. Cost-effectiveness is determined by comparing the project cost to the value of damages prevented after the mitigation measure. Given an example where the project cost is \$1,000 and the value of damages prevented after the mitigation measure is \$2,000.
2. Because the dollar-value of benefits exceeds the cost of funding the project, the project is cost-effective. This relationship is depicted numerically by dividing the benefits by the costs, resulting in a benefit cost ratio (BCR). The BCR is simply a way of stating whether benefits exceed projects costs, and by how much.
3. To derive the BCR, divide the benefits by the cost ( $\$2,000 / \$1,000$ ). If the result is 1.0 or greater, then the project is cost-effective. In this instance, the BCR is 2.0, which exceeds the 1.0 level.
4. On the other hand, if the cost of the project is \$2,000 and the benefits are only \$1,000, the project would have a BCR of 0.50 ( $\$1,000 / \$2,000$ ) and would not be cost-effective.

While the example mentioned above may be a simple one, the process and the benefit cost analysis calculations associated with it are basically the same for all mitigation projects.

Three approaches are used to determine a project's benefit cost ratio: lower-bound analysis, upper-bound analysis, and best estimate. The lower-bound and upper-bound methods are used in many cases to make final determinations of cost-effectiveness even when there is limited data. In these cases, no further benefit cost analysis is needed. In other cases, quick screening analysis with these approaches yields inconclusive results and additional data and screening may be required.

**Lower-Bound Analysis** - Lower-bound analysis is a powerful tool that can often demonstrate that projects are cost-effective, in many cases regardless of whether the available data is complete or not. This is an important point, because a project's cost-effectiveness can sometimes be determined by using only one or two key pieces of data. The lower-bound analysis was developed with this in mind.

The lower-bound analysis considers only some of a project's benefits (those that are the most important or those for which data exist) and ignores other benefits that may be difficult to estimate or for which data may not be available. In other words, this analysis purposely uses only a few pieces of information to determine the project's cost-effectiveness and undercounts, or ignores, other benefits that will be gained by funding the project. If this data indicates that a project is cost-effective, then no further analysis is needed. No additional data has to be collected.

### Lower-Bound Analysis at a Glance

1. It should be used when data is incomplete.
2. It can determine that a project is cost-effective.
3. It cannot determine that a project is not cost-effective.
4. It uses data for one or two significant benefits.

**Upper-Bound Analysis** - If a lower-bound analysis shows that a project is not cost-effective, then the next step is an upper-bound analysis. Sometimes an upper-bound analysis is used if, at first glance, the project appears not to be cost-effective. Like lower-bound analysis, upper-bound analysis relies on limited project data. Upper-bound analysis, however, also uses professional judgment to estimate about input data that give the highest reasonable benefits that can be expected from a mitigation project.

It is extremely important to note that upper-bound analysis cannot determine that a project is cost-effective. Upper-bound analysis can only determine that a project is not cost-effective.

Because it relies on the highest, reasonable estimate of benefits (prevention of damage by the project), an upper-bound analysis can only determine that the project BCR is not cost-effective (less than 1.0). The project can only be rejected as not cost-effective with this analysis. In other words, because the highest reasonable estimate of damages is used in the calculation, if the BCR is still less than 1.0, one can only conclude that the project is not cost-effective.

### Upper-Bound Analysis as a Glance

1. It can only determine that a project is not cost-effective.
2. It is used as the next step if the lower-bound analysis is negative (not cost-effective).
3. It is used if a project appears, at first glance, unlikely to be cost-effective.
4. It uses the highest reasonable estimate of benefits for a project.
5. It analyzes as many data as are possible, assigning the highest reasonable value to each.

**Best Estimate Analysis** - A best estimate analysis is used when the project application data is complete, or almost complete. This analysis provides a more accurate BCR than either lower-or upper-bound analysis because more data are considered in the analysis. As discussed earlier, however, in many cases lower-bound or upper-bound analysis can provide firm decisions about cost-effectiveness, without requiring as much data as a best estimate analysis.

If a best estimate analysis is conducted, then a project is either cost-effective or not cost-effective, because all significant data are considered. Because this method of benefit cost analysis provides the best estimate of cost-effectiveness, it can be used to rank (set priorities among) competing projects. Neither lower-bound nor upper-bound analysis are used to rank or set priorities among projects. They do not consider enough data to determine accurately specific BCRs; they product only "bounds" on BCRs (i.e.  $BCR > 1.0$  or  $BCR < 1.0$ ).

### Best Estimate Analysis at a Glance

1. It should be used when the project application data is complete, or almost complete.
2. It produces a more accurate analysis than Lower-Bound and Upper-Bound analyses.
3. It determines whether a project is cost-effective or not cost-effective.
4. BCR can be used for ranking or setting priorities among projects.

### Results of Benefit Cost Analysis

The final aim of the review process is to determine whether a project is cost-effective, or whether further analysis is required. If the project is cost-effective, the application moves to the next level in the funding process. If it is not cost-effective, the project is rejected. In some cases, additional information may be requested, or the applicant may be shown how the mitigation effort can be re-directed.

By conducting a benefit cost analysis, you determine one of three things: either the project is cost-effective ( $BCA > 1.0$ ), the project is not cost-effective ( $BCA < 1.0$ ), or additional data is required.

If the project is cost-effective, then no further analysis or additional data collection is required. If a project is determined to be cost-effective, either by a lower bound or best estimate analysis, then the project moves to the next step in the application process.

If the project is not cost-effective, then no further analysis or additional data collection is required. If the project is determined not to be cost-effective, either by an upper bound or a best estimate, then the project is not eligible for funding. Some projects require additional information to determine cost-effectiveness because the applications are very incomplete.

If the cost-effectiveness of a project cannot be determined, then additional data must be collected. It is important to recognize that only the minimum data necessary to reach a decision on project cost-effectiveness must be collected. In many cases, the collection of one or two more pieces of information are sufficient to reach a decision. A complete analysis is conducted in those relatively few cases where the BCA is close to 1.0.

## 7.2 Program Management

**Requirement 44 CFR §201.5(b)(2) (iii A-D): The Enhanced Plan must document that the State has the capability to effectively manage the HMGP as well as other mitigation grant programs, and provide a record of the following:**

Meeting HMGP and other mitigation grant application timeframes and submitting complete, technically feasible, and eligible project applications with appropriate supporting documentation;

Preparing and submitting accurate environmental reviews and benefit-cost analyses; Submitting complete and accurate quarterly progress and financial reports on time; and Completing HMGP and other mitigation grant projects within established performance periods, including financial reconciliation.



### **7.2.1 Managing State Concept for Hazard Mitigation**

Since Section 322 of the Disaster and Mitigation Assistance Act of 2000 provides for a significant increase in hazard mitigation grant program (HMGP) funding available to the State, it is critical that the State demonstrate the ability to manage the HMGP and other mitigation grant programs and has clearly demonstrated a commitment to mitigation.

The following factors were developed by FEMA for considering a State for Managing State status. Missouri has met all of these requirements and has been designated a Managing State for Hazard Mitigation since February 2001.

#### **The State's Hazard Mitigation Planning Capabilities**

The mitigation section has one individual solely devoted to hazard mitigation planning. In addition, the state uses an area coordinator system for planning. Use of these nine (9) area coordinators has been instrumental when dealing with communities on a one-on-one basis.

Missouri has developed a Local Officials Hazard All-Mitigation Planning guidebook (describes the planning process) and a Hazard Mitigation Planning Guidebook for Regional Planning Commissions (details how to prepare plans and what the plans must contain) and continually offers assistance to any community desiring to develop a Plan. Hazard Mitigation Planning is a component of the state's disaster resistant community effort.

#### **Past Performance of the State**

(in meeting established deadlines for submitting applications, quarterly financial and progress reports, hazard mitigation administrative plans and state multi-hazard mitigation plans)

The Missouri Mitigation Administrative Plan, quarterly reporting system, and Hazard Mitigation Grant Program (HMGP) applications have all been used as a model for other states to use, as well as FEMA National Headquarters. The Hazard Mitigation Administrative Plan developed by SEMA in 1995 was one of the first procedural plans ever developed that addressed additional elements not required by the Code of Federal Regulations (CFR).

In addition, the standard Hazard Mitigation Grant Program (HMGP) buyout application and quarterly reports were requested of FEMA National Headquarters a few years ago to use as the National Emergency Management Information System (NEMIS) standard.

#### **Adequate and Experienced Staff at Both the State and Regional Level**

The mitigation staff is part of SEMA's Disaster & Mitigation Assistance Branch. State hazard mitigation staff consists of two hazard mitigation specialists, one clerical assistant (Branch), and the State Hazard Mitigation Officer. All positions are permanent, full-time, and are funded with state general revenue funding.

The technical skills of all staff members are solid. To ensure consistency and smooth transitions, great care has been taken to ensure that all staff members are cross-trained and receive appropriate FEMA training. The hazard mitigation section has directly administered over \$42 million in hazard mitigation and unmet needs funding. All current staff members have received formal benefit cost analysis training. Three staff members have taken the FEMA grant

management and NEMIS training. All staff members have attended several All-Hazard Mitigation Workshops or state hazard mitigation officer training efforts.

Newly hired staff will receive direct training either from existing staff or through partnerships with other state hazard mitigation officers and will attend formal FEMA training as appropriate.

### **Region's Ability and Willingness to Provide Additional Resources and Training to the State**

Not applicable for a state response.

### **State and Regional Relationship**

The relationship between the State of Missouri and FEMA Region VII has always been maintained in an open, professional manner.

### **Expertise in the Area of Preparing Environmental Documentation and Conducting Benefit Cost Analyses**

History and the recent Memorandum of Agreement with the Missouri Department of Transportation are telling indicators of the commitment of SEMA to be able to prepare environmental documentation and conduct benefit cost analyses.

SEMA has performed all benefit cost analyses within the last four years for all hazard mitigation grant applications.

All current mitigation staff members have received formal FEMA benefit cost training and apply the software modules on a consistent basis to alleviate lapses in using the programs.

### **State Commitment to Floodplain Management**

Coordination of the National Flood Insurance Program was transferred from the Department of Natural Resources to the State Emergency Management Agency in 1995. Over the last eight years, there has been an explosive effort by state staff to bring heightened awareness and technical assistance to local communities. Training, joint seminars with the Flood Insurance Administration and an annual workshop have been institutionalized. A local guidebook and a quick reference manual have recently been released and hailed a success by local communities and FEMA.

Since 1995, approximately forty communities have joined the National Flood Insurance Program. There remains only forty-one unincorporated areas of counties (out of 114 counties) that do not participate in the program.

In July of 1997, Executive Order 97-09 was signed by the Lieutenant Governor authorizing SEMA to issue permits for any state owned or leased development in a special flood hazard area.

Floodplain staff consists of a registered professional engineer, two floodplain managers, one clerical, and the statewide coordinator.

Floodplain management enjoys vital day-to-day relationships with the statewide hazard mitigation efforts and staff. Perhaps the most profound change in the state's role in floodplain management and coordination is that state funding has increased from just under \$25,000 annually in 1995 to approximately \$300,000 per budget year.

### **State Use of the Hazard Mitigation Team to Prioritize and Select HMGP Applications and Ensure Coordination among Key State Functions**

Although a formal organization or arrangement is not always present or used by Missouri to prioritize and select HMGP projects, it is erroneous to assume that such is carried out in a vacuum. The 1993, 1994, and 1995 buyout projects were selected, coordinated, and managed by a small committee appointed by the Governor for this specific purpose.

The wisdom in this approach can be found in the results. Six months after funding became available, all projects were approved and one project was completed.

Currently, smaller projects are coordinated with CDBG, MoDOT, the Corps of Engineers and others as the situation dictates. This practice will continue with a more formal body used in the event that large HMGP opportunities are presented.

### **Demonstrated Relationship Between the State and Local Governments**

Throughout the extensive buyout program and for all mitigation projects, the state has operated on a basic principle --centralized planning with decentralized execution.

To the extent that local governments can manage projects, they are allowed to do so. However, compliance with established procedures, priorities, and "safe guard measures" is required.

Local governments have been vocal in their enthusiastic support for this approach. We routinely are told that this agency provides them with exactly with what they need to be successful.

### **Commitment to Training by the State and FEMA**

All current staff members have received formal benefit cost analysis training. Two staff members have taken the FEMA grant management and NEMIS training. All staff members have attended several All-Hazard Mitigation Workshops or state hazard mitigation officer training efforts.

Newly hired staff will receive direct training either from existing staff or through partnerships with other state hazard mitigation officers and will attend formal FEMA training as appropriate. Training for local units of government before and following an HMGP award is ongoing, formal, or in-formal depending on the needs of the community.

## 7.3 Assessment of Mitigation Actions

**Requirement 44 CFR §201.5(b)(2) (iv): The Enhanced Plan must document the system and strategy by which the State will conduct an assessment of the completed mitigation actions and include a record of the effectiveness (actual cost avoidance) of each mitigation action.**

Currently, the Floodplain Management & Mitigation Assistance Branch assesses the effectiveness of mitigation based on following system. Before any mitigation project is approved by SEMA, it must comply with the following items as a minimum:

1. Complement the overall mitigation strategy of the State and applicable local government;
2. Suitable funding, to include the local match (if needed), must be available;
3. The project must be cost-effective. The FEMA benefit cost module is generally used to make this determination;
4. The project must be in compliance with all other federal, State, and local regulations and policies; and
5. The project must provide a benefit to the community at large.

It may be difficult to determine the actual cost avoidance and effectiveness of many mitigation projects during the development of the projects. Initially, the potential impact of these mitigation projects and initiatives can only be estimated. However, based on past experience with similar projects, SEMA can make an educated determination as to the potential for success of the proposed mitigation project.

Evaluation of future disasters and their impact on a community is another means of evaluating the success of a mitigation project. This method was used in evaluating the success of the buy-out program. In simple terms, by removing a structure (family) from the flood hazard area, we reduce the potential threat to that family and the associated disaster assistance costs. For example, the flood of '95 was significantly equal to the flood of '93 in terms of the built up areas in the majority of communities undertaking a flood buyout program as a result of the '93 flood. However, the buyouts dramatically reduced the costs associated with the '95 flood because the properties were no longer there. Following the '93 floods, FEMA, SEMA, CDBG and local communities worked about 45 buyout projects covering more than 4,000 properties at a cost of approximately \$100M. The '95 flood resulted in only 3 buyout projects for 149 properties at a cost of less than \$5M. The NFIP paid out approximately \$56M in claims in the '93 floods, but only a little over one half million after the '95 flooding. SEMA publishes success stories like these in *Stemming the Tide of Flood Losses* and provides success stories to FEMA and to organizations like the Association of State Floodplain Program Managers to educate the public about the effectiveness of mitigation.

In addition, SEMA is in the process of using GIS and GPS technology to further document the buyouts to further refine the monitoring of the projects of the program to improve the accuracy of future assessments. SEMA uses GIS coordinates to mark and then map the lots acquired through buyout programs for reference to help monitor compliance with "Open Space" deed restrictions. SEMA also requires participating communities to implement procedures for

monitoring the “Open Space” that has resulted from these buyout projects to ensure that the at risk areas are not inappropriately redeveloped, resulting in the reduction of the program’s effectiveness.

## **Mitigation Measures Assessment Strategy**

### **7.3.1 Annual Progress Assessment/Review for Mitigation Goals, Objectives and Measures**

In order for any program to remain effective, the goals and objectives of that program must be reviewed periodically. That review should address, as a minimum, the following issues:

1. Are the established goals and objectives realistic? Take into consideration available funding, staffing, and state/local capabilities, and the overall State mitigation strategy.
2. Has the State clearly explained the overall mitigation strategy to local governments?
3. Are proposed mitigation projects evaluated based on how they help the State and/or local government meet their overall mitigation goals and objectives?
4. How have approved mitigation projects complemented existing State and/or local government mitigation goals and objectives?
5. Have completed mitigation projects generated the anticipated cost avoidance or other disaster reduction result?

A thorough and realistic evaluation of the benefits of a mitigation project may be delayed until the area of the project is impacted by another disaster. The lack of realized benefits from a completed mitigation project may result in the disapproval or modification of similar projects in the future. At the same time, mitigation projects that have proven their worth may be repeated in other areas of the State.

Based on the results of the assessment/evaluation mentioned above, the State may need to adjust its goals, objectives, and measures to meet the current and future mitigation needs of the State and local governments. A formal mitigation status report will be prepared by the SEMA Floodplain Management & Mitigation Assistance Branch on an annual basis. This report will be provided to the SEMA Director and Deputy Director for review and distribution, as needed. The report will address, as a minimum, the following items:

1. Completed mitigation projects
  - Affected jurisdiction
  - Brief description of the project
  - Source of funding
  - Brief summary of any problem areas, with proposed solution
  - Brief summary of effectiveness (cost-avoidance) of project, if available

2. Mitigation projects in progress
  - a. Affected jurisdiction
  - b. Brief description of the project
  - c. Source of funding
  - d. Brief summary of project status
  - e. Anticipated completion date
3. Pending (under review) mitigation projects
  - a. Affected jurisdiction
  - b. Brief description of the project
  - c. Source of funding
  - d. Brief summary of project status

Before any mitigation project is approved by SEMA, it must comply with the following items as a minimum:

1. Complement the overall mitigation strategy of the State and applicable local government;
2. Suitable funding, to include the local match (if needed), must be available;
3. The project must be cost-effective. The FEMA benefit cost module is generally used to make this determination;
4. The project must be in compliance with all other federal, State, and local regulations and policies; and
5. The project must provide a benefit to the community at large.

It may be difficult to determine the actual cost avoidance and effectiveness of many mitigation projects during the development of the projects. Initially, the potential impact of these mitigation projects and initiatives can only be estimated. However, based on past experience with similar projects, SEMA can make an educated determination as to the potential for success of the proposed mitigation project.

Following natural and/or man made hazardous events, SEMA Mitigation Staff will query local officials to document how mitigation measures instituted in the effected areas lessened the amount of damages or loss of life, that may have resulted from those events. Within the next three years, SEMA will continue to develop standard operating procedures to enhance the opportunities to analyze successes.

### **7.3.2 Post Disaster Progress Assessment/Review for Mitigation Goals, Objectives and Measures**

Findings and information obtained from the above-mentioned annual report and from information received immediately after a disaster, results and conclusion will be incorporated into mitigation success stories to aid in the assessment of the current and future goals, objectives, and measures.

Evaluation of future disasters and their impact on a community is another means of evaluating the success of a mitigation project. This method was used in evaluating the success of the buy-out program. In simple terms, by removing a structure (family) from the flood hazard area, we reduce the potential threat to that family and the associated disaster assistance costs. For example, the flood of '95 was significantly equal to the flood of '93 in terms of the built up areas in the majority of communities undertaking a flood buyout program as a result of the '93 flood. However, the buyouts dramatically reduced the costs associated with the '95 flood because the properties were no longer there. Following the '93 floods, FEMA, SEMA, CDBG and local communities worked about 45 buyout projects covering more than 4,000 properties at a cost of approximately \$100M. The '95 flood resulted in only 3 buyout projects for 149 properties at a cost of less than \$5M. The NFIP paid out approximately \$56M in claims in the '93 floods, but only a little over one half million after the '95 flooding. SEMA publishes success stories like these in *Stemming the Tide of Flood Losses* and provides success stories to FEMA and to organizations like the Association of State Floodplain Program Managers to educate the public about the effectiveness of mitigation.

In addition, during the next three years, SEMA will be in the process of implementing GIS and GPS technology to further document the buyouts to further refine the monitoring of the projects of the program to improve the accuracy of future assessments. SEMA uses GIS coordinates to mark and then map the lots acquired through buyout programs for reference to help monitor compliance with "Open Space" deed restrictions. SEMA also requires participating communities to implement procedures for monitoring the "Open Space" that has resulted from these buyout projects to ensure that the at risk areas are not inappropriately redeveloped, resulting in the reduction of the program's effectiveness. Once this phase is complete, SEMA will develop a database to track and measure the effectiveness of the mitigation measures funded.

## **7.4 Effective Use of Available Mitigation Funding**

**Requirement 44 CFR §201.5(b)(3): The Enhanced Plan must demonstrate that the State effectively uses existing mitigation programs to achieve its mitigation goals.**

This section identifies some general and specific hazard mitigation projects. They provide examples of the types of projects that have made, and continue to make, the State of Missouri Hazard Mitigation Program effective and successful. These projects, and others like them, have been approved in the past, based on their ability to achieve some, or all, of the State's mitigation goals and objectives. Because of this demonstrated success, similar projects would most likely be approved in the future.

The following list provides some general types of projects that have been approved as part of the State's mitigation program. This list is not all-inclusive and is subject to a variety of issues, such as, the completion and/or change of established goals and objectives, availability of funds, cost-effectiveness determinations, etc.

### **Acquisition of Primary Residences in Floodprone Areas**

The State has previously, and most likely will continue to, place a priority on the acquisition of primary residences in floodprone areas. Hazard Mitigation Grant Program (HMGP) funds from previous disasters in the State have been used to fund this extremely successful program. It was recognized as a model for the nation following the devastating 1993 floods.

This program removed families from harm's way. By doing so, it eliminated the threat of flooding and the associated financial and emotional hardship on those families that participated in the program; reduced the cost of future disasters to the federal, state, and local government; and provided the participating community with open space to develop parks for the entire community to enjoy.

### **Increase Weather Radio Coverage**

The State of Missouri, through the State Emergency Management Agency (SEMA), and in cooperation with the National Weather Service, local governments, electric cooperatives, and private enterprises, has significantly increased the coverage provided by the NOAA weather radio warning system.

As a direct result of these unprecedented public-private partnerships, the State of Missouri will have almost complete geographic coverage utilizing mostly private, donated tower space for these transmitters. The citizens of this State are the primary beneficiaries of the efforts of all of these agencies and businesses.

The warnings provided by this system will give Missouri citizens the time they need to protect their families and their property in the event of severe weather.

### **Prepare/Update Floodplain Maps**

Funds from a variety of programs have been used to develop flood maps for previously unmapped areas and to revise/update older existing maps. This initiative will enable more communities within the State to join the National Flood Insurance Program (NFIP). As a result, more individuals, families, and businesses can obtain insurance to cover flood related losses in the future.

### **Develop Local Hazard Mitigation Plans**

Funds from these programs have been used to assist communities throughout the State in developing much needed hazard mitigation plans. As part of this process, these communities have developed public-private partnerships that have taken the opportunity to expand their work into other mitigation related initiatives. As a result of these initial planning activities, communities have become more aware of the benefits of an active mitigation program and have instituted mitigation projects using their own funds.



### **Other Mitigation Measures**

From time to time, other mitigation measures have been warranted if proven to be cost effective solutions to problems. For example, when enough past damage was adequately documented, it was possible win approval to bury electric service lines from the street to the meter on residences to mitigate the adverse effects of severe weather. These projects have been required to fulfill all the requirements for flood mitigation projects and possibly have had other additional requirements depending on the nature of the project.

### **Public Outreach**

SEMA also has had a robust effort to educate the public, local officials, government officials, schools, private associations and businesses concerning the value and importance of mitigation programs. SEMA has offered mitigation workshops, participated in public forums, provided one-on-one counseling, presented at conferences, provided written materials, developed guidebooks and manuals, published success stories, sent out press releases, provided training materials to local emergency managers, earthquake program partners, floodplain managers, businesses and offered information on the Internet.

### **7.4.1 Mitigation Success**

The following list provides some examples of specific hazard mitigation projects that have been approved in the past as part of the State's mitigation program. This list is not all-inclusive and is intended only to show some of the types of mitigation projects that have been developed and approved within Missouri. As with any hazard mitigation project, these projects were subject to the same requirements of cost-effectiveness, availability of funds, compliance with established mitigation goals and objectives, availability of funds, etc.

#### **Reservoirs, Levees and Flood Walls**

During the Great Flood of 1993, flood damage reduction structures prevented and estimated \$19.1 billion in potential additional damages, according to the May 26, 1994 Draft Report of the Interagency Floodplain Management Review Committee. Of that, it is estimated that at least \$11.5 billion damage was prevented along the Missouri River. This is based on \$7.4 billion from the management of floodwater stored in reservoirs, and \$4.1 billion damage prevented by levees. Reservoirs, Levees and Flood Walls prevented damage of approximately \$5.6 billion in Kansas City.

Another study, conducted by a former U.S. Army Corps of Engineers (COE) District engineer, estimated flood damage in the St. Louis COE District at \$1.4 billion. At the same time, the study found damage prevented by federal flood damage reduction components estimated at \$5.4 billion. Thus, an 80% reduction in potential damage was achieved in the St. Louis COE area.

#### **Department of Natural Resources (DNR) Stormwater Improvements**

In 2001, the Missouri Department of Natural Resources awarded more than \$9.9 million to 46 Missouri communities for stormwater improvements. Of these 46 communities, seven (7) of them had populations of 3,000 or less. Funding for these grants came from bond issues approved by Missouri voters in 1988 and 1998 for improvements to stormwater, wastewater treatment, and public drinking water systems.

The types of projects approved by DNR included, but are not limited to:

1. Drainage modifications to prevent pooling water, reduce stream bank erosion, reduce localized flooding, and improve discharge water quality;
2. Buyout and demolish flood-prone homes;
3. Replacing undersized drainage systems to prevent flooding of houses and streets;
4. Channel stabilization and drainage improvement;
5. Modify existing detention basin outlet for better storage capacity and help downstream flooding;
6. Development of city and county-wide stormwater management plans;
7. Construction of stormwater collection and control systems;
8. Combinations of biostabilization measures and upstream detention to alleviate existing erosion and to prevent future channel degradation based on anticipated future development conditions; and
9. Construction of new storm sewer systems.

#### **NOAA Weather Radio**

These tone alert radios provide continuous weather coverage and can be programmed to sound when severe weather watches, warnings, or other critical information is broadcast by the National Weather Service (NWS). They are designed to automatically sound when warnings are issued.

In 1998, there were only ten (10) weather radio transmitters providing coverage in the State of Missouri. Because of the joint efforts of many electric cooperatives, private businesses, NWS, FEMA, and SEMA, there are currently thirty-one (32) transmitters operating in the state, providing nearly 100 percent coverage of the state as noted below.

MISSOURI [state map](#) [map use notes](#)

NWR TRANSMITTER...	MO CALL	FREQ MHZ	WATTS	<a href="#">NWS PROGRAMMING OFFICE</a>
1. ALTON	MO KXI35	162.500	300	SPRINGFIELD, MO
2. BOURBON	MO WWF75	162.525	1000	ST. LOUIS, MO
3. BRANSON	MO KZZ43	162.550	1000	SPRINGFIELD, MO
4. CAMDENTON	MO WXJ90	162.550	1000	SPRINGFIELD, MO
5. CAMERON	MO KZZ85	162.475	300	KANSAS CITY/PLEASANT HILL, MO
6. CARROLLTON	MO KZZ34	162.450	1000	KANSAS CITY/PLEASANT HILL, MO
7. CAPE GIRARDEAU	MO KXI93	162.550	300	SPRINGFIELD, MO
8. CLINTON	MO KXI99	162.500	1000	KANSAS CITY/PLEASANT HILL, MO
9. COLUMBIA	MO WXL45	62.400	1000	ST. LOUIS, MO
10. DEXTER	MO WXL47	162.400	1000	PADUCAH, KY
11. DIXON	MO WNG648	162.500	1000	SPRINGFIELD, MO
12. DONIPHAN	MO WWG48	162.450	1000	PADUCAH, KY
13. ELDORADO SPRINGS	MO KZZ30	162.475	1000	SPRINGFIELD, MO
14. FREDRICKTOWN	MO WWG49	162.500	1000	ST. LOUIS, MO
15. GAINESVILLE	MO KZZ82	162.425	1000	SPRINGFIELD, MO
16. HANNIBAL	MO WXK82	162.475	1000	ST. LOUIS, MO
17. HERMITAGE	MO WXM81	162.450	100	SPRINGFIELD, MO
18. JAMESTOWN	MO KWN55	162.425	1000	ST. LOUIS, MO
19. JOPLIN	MO WXJ61	162.425	1000	SPRINGFIELD, MO
20. KAHOKA	MO WXL99	162.450	300	QUAD CITIES, IA
21. KANSAS CITY	MO KID77	162.550	1000	KANSAS CITY/PLEASANT HILL, MO
22. LA PLATA	MO WXM39	162.525	300	KANSAS CITY/PLEASANT HILL, MO
23. LANCASTER	MO WXM36	162.550	300	KANSAS CITY/PLEASANT HILL, MO
24. MARYVILLE	MO KZZ37	162.425	1000	KANSAS CITY/PLEASANT HILL, MO
25. PIEDMONT	MO KXI66	162.425	1000	PADUCAH, KY
26. SPRINGFIELD	MO WXL46	162.400	1000	SPRINGFIELD, MO
27. ST. JOSEPH	MO KEC77	162.400	1000	KANSAS CITY/PLEASANT HILL, MO
28. ST. LOUIS	MO KDO89	162.550	1000	ST. LOUIS, MO
29. SUMMERSVILLE	MO WWF76	162.475	1000	SPRINGFIELD, MO
30. TRENTON	MO KZZ38	162.500	1000	KANSAS CITY/PLEASANT HILL, MO
31. WARDELL	MO WWG47	162.525	1000	MEMPHIS, TN
32. WEST PLAINS	MO KXI38	162.525	300	SPRINGFIELD, MO

The expanded severe weather warning coverage provided by these transmitters benefit everyone in the State. By providing early warnings for severe weather, these transmitters enable people in the affected areas to take cover and help protect themselves from the affects of most severe weather situations.

### Missouri Community Buyout Program

In the aftermath of the Summer 1993 flood, the State of Missouri launched an unprecedented statewide hazard mitigation effort through the Community Buyout Program. This was a voluntary program designed to acquire residential properties in the floodplain and move residents out of harm's way. The Buyout program utilized a mix of federal funds, including Section 404 (Hazard Mitigation Grant Program), Section 406 (Public Assistance), and Missouri Community Development Block Grants (CDBG). Then-Governor Mel Carnahan conservatively estimated

the Buyout Program would save the State of Missouri an estimated \$200 million in flood fighting costs, Individual Assistance, and flood insurance claims over the next 20 years.

But, no one could predict Missouri would have the opportunity to test the buyout's effectiveness as quickly as it did when the spring 1995 flood (MO-DR 1054) struck. The third worst flood of record in many places, there were some 2,000 families no longer living in the flood plain in 1995, due to the buyout program. Removing these repetitive loss properties from harm's way saved millions in disaster assistance and emergency protective measures statewide, which would have been needed, were it not for the buyout.

Participating buyout communities were able to focus their efforts on the flood response. They did not have to use their precious resources on evacuating residents or sandbagging structures to save private property in the floodplain. Likewise, claims for flood insurance and applications for assistance, such as loans with the Small Business Administration (SBA), or the Individual and Family Grant (IFG) Program, were minimized.

Some additional facts related to this particular buyout program are:

- The Flood of 1995 was significantly equal to the Flood of 1993 in the majority of communities undertaking a flood buyout program after the 1993 Flood.
- The cost of human suffering was dramatically reduced in 1995, however, thanks to the Missouri Buyout program and the associated demolition of about 2/3 of the flood prone homes after the Flood of 1993.
- The reason is simple; fewer people were in harm's way during the Flood of 1995, thanks to Missouri's highly successful buyout program.
- Flood insurance payments paid out on flood buyout properties, more than \$22.6 million for the 1993 and 1995 flood events, are flood payments that will never be paid out again.

Listed below are more examples of the types of mitigation projects that have been undertaken by communities throughout the State. These projects were cost-effective based on the FEMA benefit cost analysis module, and they provided a benefit to the community in which they were completed by decreasing the impact of similar disasters.

*City of Richmond* -- Drop box installation (\$2,434.00), to alleviate flooding caused by storm water run-off, which exceeded capacity of old drainage system.

*Moniteau County* -- Culvert Replacement at 4 locations (\$8,731.00), to replace and upgrade culverts at 4 locations throughout the county.

*Platte County* -- Culvert Upgrade at 2 locations (\$20,371.00), to upgrade culverts where capacity was not sufficient to handle run-off from heavy rain events.

*Platte County* -- Sewer Upgrade (\$11,926.99), to replace storm sewer in residential area, which was no longer collecting storm water.

*City of Blue Springs* -- Sewer Upgrade (\$177,455.00), to increase capacity of sanitary sewer system in residential area, which would overflow during heavy rain events.

*City of Grain Valley* -- Culvert Upgrade (\$91,000.00), to increase capacity of stormwater culvert in residential area, which would overflow during heavy rain events.

*City of Grain Valley* -- Manhole Repairs (\$32,979.00), to clean, repair, and seal 48 manholes to prevent infiltration of stormwater into the sanitary sewer system.

*City of Lee's Summit* -- Sewer Upgrade (\$669,000.00), to increase capacity of sanitary sewer system in residential area, which would overflow during heavy rain events.

*City of Greenwood* -- Sewer Upgrade (\$288,233.00), to replace existing storm sewer system in residential area, which had deteriorated to 10% of capacity.

*City of Savannah* --Sewer Improvements (\$336,837.00), to install improved drainage system in commercial and residential area, which overflowed during heavy rain events.

The following table (**Table 51**) highlights some of the key data relating to the success of the Missouri Buyout Program. It provides data comparing the buyout programs for the 1993 and the 1995 disasters within the State of Missouri. The table provides a good comparison to highlight the overall success of the Missouri Buyout program.

Table 51. Missouri's Buyout Success Story

	<b>Total</b>	<b>1993</b>	<b>1995</b>
Total Number of Buyout Projects	48	45	3
Number of Parcels Acquired*	4,193	4,044	149
Hazard Mitigation Grant to State**	\$32.1 Million	\$30.0 Million	\$2.1 Million
Total Cost of Buyout Projects	\$59.1 Million	\$56.8 Million	\$2.3 Million
Total Flood Insurance Claims Paid***	\$22.7 Million	\$22.1 Million	\$563,393.00
SBA Loans Repaid (45%)	\$5.7 Million	\$5.4 Million	\$321,542.00
Property Acquired: (Fair Market Value)****	\$78.1 Million	\$75.2 Million	\$2.9 Million

\*The State of Missouri only received \$2.1 million in HMGP funds in '95 as compared to the \$30 million after the '93 flood.

\*\*Through local governments, the state of Missouri was able to acquire 4,044 properties after the Flood of '93 for roughly \$56.8 million. This is an average cost of \$14,045. Although the properties had an average pre-flood fair market value of \$18,500, because of flood payments paid prior to closing and deducted from the pre-flood value, the cost to acquire flooded properties was considerably less to the State.

\*\*\*(SBA) Small Business Administration - The flood claims paid out on property acquired through the buyout in '93 was more than \$22.1 million. Only \$563,393 was paid out in '95 on the homes that were eventually acquired after the '95 flood. Additional assistance of more than \$4 million was also paid by FEMA to property owners participating in the buyout. Again, these payments will NEVER be paid again.

\*\*\*\*Of the more than \$1.9 million in SBA loans paid out on flood-damaged property, \$5.4 million was repaid by property owners at the time of the buyout closing. In 1995, 100 percent of SBA loans paid out on flood-damaged property were repaid at the time of closing.

## 7.5 Commitment to a Comprehensive Mitigation Program

**Requirement 44 CFR §201.5(b)(4)(i-vi): The Enhanced Plan must demonstrate that the State is committed to a comprehensive State mitigation program, which might include any of the following:**

A commitment to support local mitigation planning by providing workshops and training, State planning grants, or coordinated capability development of local officials, including Emergency Management and Floodplain Management certifications.

A Statewide program of hazard mitigation through the development of legislative initiatives, mitigation councils, formation of public/private partnerships, and /or other executive actions that promote hazard mitigation.

The State provides a portion of the non-Federal match for HMGP and/or other mitigation projects.

To the extent allowed by State Law, the State requires or encourages local governments to use a current version of a nationally applicable model building code or standard that addresses natural hazards as a basis for design and construction of State sponsored mitigation projects.

A comprehensive, multi-year plan to mitigate the risks posed to the existing buildings that have been identified as necessary for post-disaster response and recovery operations.

A comprehensive description of how the State integrates mitigation into its post-disaster recovery operations.

Please see:

Section 2.0, page 10, for organizations within the state that have consistently promoted mitigation:

- Governor’s Task Force of Flood Plain Management
- Long-Term Recovery/Unmet Needs Groups
- Structural Assessment and Visual Evaluation (SAVE) Coalition
- Missouri Seismic Safety Commission
- Regional Planning Commissions/Councils
- State Hazard Mitigation Project Coordinating Group

Section 3.3, pages 169-212, for a demonstration of additional commitment in mitigation development.

Section 4.0, for an outline of the mitigation objectives identified to raise the level of mitigation commitment:

- Objective 1.3 – Supports the development of sensible enabling legislation, programs and capabilities of federal, state, and local governments and public-private partnerships engaged in mitigation activities.
- Objective 2.5 - Encourages federal, state and local officials, educational institutions, private associations and private business entities that provide essential services to incorporate mitigation into other plans.
- Objective 3.2 – Strengthens cooperation with SEMA’s mitigation partners and helps educate them about mitigating the loss of property.
- Objective 4.2 – Considers Sustainability issues (ecologically sound, economically viable, socially just and humane) when developing or reviewing mitigation projects and plans.

In addition, the plan demonstrates a commitment to address the “data limitation” noted in the risk assessment and hazard analysis and the lack of approved local hazard mitigation plans through the establishment of Mitigation Action #M1 – State and Local Hazard Mitigation Plans.

Table 51, page 308, for a summary of the Missouri Buyout Success Story. The state has acquired 4,193 parcels, representing \$78.1 million of assessed property values.

## Appendix 1 - Listing of all counties and communities within the State of Missouri.

For more information about 1990 and 2000 census population information for every county (114) and every municipality (951) in the State of Missouri, visit the Missouri Census Data Center on the Internet at [http://mcdc2.missouri.edu/websas/dp3\\_2ktmenus/mo/Places/](http://mcdc2.missouri.edu/websas/dp3_2ktmenus/mo/Places/).

County	Community Type	Community Name	Population 2000	Average Income Per Capita	Per Capita Income % of US 1999
<b>Adair</b>	<b>County</b>	<b>County-Wide</b>	<b>24,977</b>	<b>\$19,542.00</b>	<b>68.5</b>
Adair	City	Brashear	280	\$0.00	
Adair	Village	Gibbs	100	\$0.00	
Adair	City	Greentop	427	\$0.00	
Adair	City	Kirksville	16,988	\$0.00	
Adair	Village	Millard	75	\$0.00	
Adair	City	Novinger	534	\$0.00	
<b>Andrew</b>	<b>County</b>	<b>County-Wide</b>	<b>16,492</b>	<b>\$22,718.00</b>	<b>79.6</b>
Andrew	City	Amazonia	277	\$0.00	
Andrew	City	Bolckow	234	\$0.00	
Andrew	Village	Cosby	143	\$0.00	
Andrew	Village	Country Club	1,846	\$0.00	
Andrew	City	Fillmore	211	\$0.00	
Andrew	Village	Rea	56	\$0.00	
Andrew	City	Rosendale	180	\$0.00	
Andrew	City	Savannah	4,762	\$0.00	
<b>Atchison</b>	<b>County</b>	<b>County-Wide</b>	<b>6,430</b>	<b>\$20,895.00</b>	<b>73.2</b>
Atchison	City	Fairfax	645	\$0.00	
Atchison	City	Rock Port	1,395	\$0.00	
Atchison	City	Tarkio	1,935	\$0.00	
Atchison	Village	Watson	121	\$0.00	
Atchison	City	Westboro	163	\$0.00	
<b>Audrain</b>	<b>County</b>	<b>County-Wide</b>	<b>25,853</b>	<b>\$23,175.00</b>	<b>81.2</b>
Audrain	Village	Benton City	122	\$0.00	
Audrain	City	Farber	411	\$0.00	
Audrain	City	Ladsonia	620	\$0.00	
Audrain	City	Martinsburg	326	\$0.00	
Audrain	City	Mexico	11,320	\$0.00	
Audrain	Village	Rush Hill	130	\$0.00	
Audrain	City	Vandalia	2,529	\$0.00	
Audrain	Village	Vandiver	83	\$0.00	
<b>Barry</b>	<b>County</b>	<b>County-Wide</b>	<b>34,010</b>	<b>\$18,739.00</b>	<b>65.6</b>
Barry	Village	Arrow Point	133	\$0.00	
Barry	Village	Butterfield	397	\$0.00	
Barry	City	Cassville	2,890	\$0.00	
Barry	Village	Chain-O-Lakes	127	\$0.00	
Barry	Village	Emerald Beach	250	\$0.00	



County	Community	Community Name	Population	Average Income	Per Capita Income
	Type		2000	Per Capita	% of US 1999
Barry	City	Exeter	707	\$0.00	
Barry	City	Monett	7,396	\$0.00	
Barry	City	Purdy	1,103	\$0.00	
Barry	City	Seligman	877	\$0.00	
Barry	City	Washburn	448	\$0.00	
Barry	City	Wheaton	721	\$0.00	
<b>Barton</b>	<b>County</b>	<b>County-Wide</b>	<b>12,541</b>	<b>\$19,759.00</b>	<b>69.2</b>
Barton	Village	Burgess	70	\$0.00	
Barton	City	Golden City	884	\$0.00	
Barton	City	Lamar	4,425	\$0.00	
Barton	Village	Lamar Heights	216	\$0.00	
Barton	City	Liberal	779	\$0.00	
Barton	Village	Milford	52	\$0.00	
Barton	City	Mindenmines	409	\$0.00	
<b>Bates</b>	<b>County</b>	<b>County-Wide</b>	<b>16,653</b>	<b>\$18,888.00</b>	<b>66.2</b>
Bates	City	Adrian	1,780	\$0.00	
Bates	City	Amoret	211	\$0.00	
Bates	City	Amsterdam	281	\$0.00	
Bates	City	Butler	4,209	\$0.00	
Bates	City	Drexel	1,090	\$0.00	
Bates	Village	Foster	130	\$0.00	
Bates	City	Hume	337	\$0.00	
Bates	Village	Merwin	83	\$0.00	
Bates	Village	Passaic	40	\$0.00	
Bates	City	Rich Hill	1,461	\$0.00	
Bates	City	Rockville	162	\$0.00	
<b>Benton</b>	<b>County</b>	<b>County-Wide</b>	<b>17,180</b>	<b>\$16,338.00</b>	<b>57.2</b>
Benton	City	Cole Camp	1,028	\$0.00	
Benton	Village	Ionia	108	\$0.00	
Benton	City	Lincoln	1,026	\$0.00	
Benton	City	Warsaw	2,070	\$0.00	
<b>Bollinger</b>	<b>County</b>	<b>County-Wide</b>	<b>12,029</b>	<b>\$15,311.00</b>	<b>53.6</b>
Bollinger	Village	Glen Allen	145	\$0.00	
Bollinger	City	Marble Hill	1,502	\$0.00	
Bollinger	Village	Sedgewickville	197	\$0.00	
Bollinger	Village	Zalma	93	\$0.00	
<b>Boone</b>	<b>County</b>	<b>County-Wide</b>	<b>135,454</b>	<b>\$26,568.00</b>	<b>93.1</b>
Boone	City	Ashland	1,869	\$0.00	
Boone	City	Centralia	3,774	\$0.00	
Boone	City	Columbia	84,531	\$0.00	
Boone	City	Hallsville	978	\$0.00	
Boone	Village	Harrisburg	184	\$0.00	
Boone	Village	Hartsburg	108	\$0.00	
Boone	Village	McBaine	17	\$0.00	

County	Community	Community Name	Population	Average Income	Per Capita Income
	Type		2000	Per Capita	% of US 1999
Boone	City	Rocheport	208	\$0.00	
Boone	City	Sturgeon	944	\$0.00	
<b>Buchanan</b>	<b>County</b>	<b>County-Wide</b>	<b>85,998</b>	<b>\$23,964.00</b>	<b>83.9</b>
Buchanan	Village	Agency	599	\$0.00	
Buchanan	City	De Kalb	257	\$0.00	
Buchanan	City	Easton	258	\$0.00	
Buchanan	City	Gower	1,399	\$0.00	
Buchanan	Village	Rushville	280	\$0.00	
Buchanan	Village	Lewis and Clark Village	155	\$0.00	
Buchanan	City	St. Joseph	73,990	\$0.00	
<b>Butler</b>	<b>County</b>	<b>County-Wide</b>	<b>40,867</b>	<b>\$21,590.00</b>	<b>75.6</b>
Butler	City	Fisk	363	\$0.00	
Butler	City	Neelyville	487	\$0.00	
Butler	City	Poplar Bluff	16,651	\$0.00	
Butler	City	Qulin	467	\$0.00	
<b>Caldwell</b>	<b>County</b>	<b>County-Wide</b>	<b>8,969</b>	<b>\$17,394.00</b>	<b>60.9</b>
Caldwell	City	Braymer	910	\$0.00	
Caldwell	City	Breckenridge	454	\$0.00	
Caldwell	City	Cowgill	247	\$0.00	
Caldwell	City	Hamilton	1,813	\$0.00	
Caldwell	City	Kidder	271	\$0.00	
Caldwell	City	Kingston	287	\$0.00	
Caldwell	City	Polo	582	\$0.00	
<b>Callaway</b>	<b>County</b>	<b>County-Wide</b>	<b>40,766</b>	<b>\$21,199.00</b>	<b>74.3</b>
Callaway	City	Auxvasse	901	\$0.00	
Callaway	City	Fulton	12,128	\$0.00	
Callaway	City	Holts Summit	2,935	\$0.00	
Callaway	City	Jefferson City	39,636	\$0.00	
Callaway	Village	Kingdom City	121	\$0.00	
Callaway	City	Lake Mykee Town	326	\$0.00	
Callaway	City	Mokane	188	\$0.00	
Callaway	City	New Bloomfield	599	\$0.00	
<b>Camden</b>	<b>County</b>	<b>County-Wide</b>	<b>37,051</b>	<b>\$22,667.00</b>	<b>79.4</b>
Camden	City	Camdenton	2,779	\$0.00	
Camden	Village	Climax Springs	80	\$0.00	
Camden	City	Lake Ozark	1,489	\$0.00	
Camden	City	Linn Creek	280	\$0.00	
Camden	City	Macks Creek	267	\$0.00	
Camden	City	Osage Beach	3,662	\$0.00	
Camden	City	Richland	1,805	\$0.00	
Camden	City	Stoutland	177	\$0.00	
Camden	Village	Sunrise Beach	368	\$0.00	
Camden	Village	Village of Four Seasons	1,493	\$0.00	

County	Community	Community Name	Population	Average Income	Per Capita Income
	Type		2000	Per Capita	% of US 1999
<b>Cape Girardeau</b>	<b>County</b>	<b>County-Wide</b>	<b>68,693</b>	<b>\$24,886.00</b>	<b>87.2</b>
Cape	Village	Allenville	104	\$0.00	
Cape	City	Cape Girardeau	35,349	\$0.00	
Cape	City	Delta	517	\$0.00	
Cape	Village	Dutchtown	99	\$0.00	
Cape	Village	Gordonville	425	\$0.00	
Cape	City	Jackson	11,947	\$0.00	
Cape	Village	Oak Ridge	202	\$0.00	
Cape	Village	Old Appleton	82	\$0.00	
Cape	Village	Pocahontas	127	\$0.00	
Cape	Village	Whitewater	113	\$0.00	
<b>Carroll</b>	<b>County</b>	<b>County-Wide</b>	<b>10,285</b>	<b>\$20,440.00</b>	<b>71.6</b>
Carroll	City	Bogard	234	\$0.00	
Carroll	City	Bosworth	382	\$0.00	
Carroll	City	Carrollton	4,122	\$0.00	
Carroll	City	De Witt	120	\$0.00	
Carroll	City	Hale	473	\$0.00	
Carroll	City	Norborne	805	\$0.00	
Carroll	Village	Tina	193	\$0.00	
<b>Carter</b>	<b>County</b>	<b>County-Wide</b>	<b>5,941</b>	<b>\$15,652.00</b>	<b>54.8</b>
Carter	City	Ellsinore	363	\$0.00	
Carter	City	Grandin	236	\$0.00	
Carter	City	Van Buren	845	\$0.00	
<b>Cass</b>	<b>County</b>	<b>County-Wide</b>	<b>82,092</b>	<b>\$23,351.00</b>	<b>81.8</b>
Cass	City	Archie	890	\$0.00	
Cass	Village	Baldwin Park	115	\$0.00	
Cass	City	Belton	21,730	\$0.00	
Cass	City	Cleveland	592	\$0.00	
Cass	City	Creighton	322	\$0.00	
Cass	City	East Lynne	300	\$0.00	
Cass	City	Freeman	521	\$0.00	
Cass	City	Garden City	1,500	\$0.00	
Cass	Village	Gunn City	85	\$0.00	
Cass	City	Harrisonville	8,946	\$0.00	
Cass	City	Lake Annette	163	\$0.00	
Cass	City	Lake Winnebago	902	\$0.00	
Cass	City	Lee's Summit	70,700	\$0.00	
Cass	City	Peculiar	2,604	\$0.00	
Cass	City	Pleasant Hill	5,582	\$0.00	
Cass	City	Raymore	11,146	\$0.00	
Cass	City	Strasburg	136	\$0.00	
Cass	Village	West Line	95	\$0.00	
Cass	City	Kansas City	441,545	\$0.00	
<b>Cedar</b>	<b>County</b>	<b>County-Wide</b>	<b>13,733</b>	<b>\$16,712.00</b>	<b>58.5</b>

County	Community	Community Name	Population	Average Income	Per Capita Income
	Type		2000	Per Capita	% of US 1999
Cedar	City	El Dorado Springs	3,775	\$0.00	
Cedar	Village	Jerico Springs	259	\$0.00	
Cedar	City	Stockton	1,960	\$0.00	
Cedar	Village	Umber View Heights	52	\$0.00	
<b>Chariton</b>	<b>County</b>	<b>County-Wide</b>	<b>8,438</b>	<b>\$19,297.00</b>	<b>67.6</b>
Chariton	City	Brunswick	925	\$0.00	
Chariton	Village	Dalton	27	\$0.00	
Chariton	City	Keytesville	533	\$0.00	
Chariton	City	Marceline	2,558	\$0.00	
Chariton	City	Mendon	208	\$0.00	
Chariton	Village	Rothville	93	\$0.00	
Chariton	City	Salisbury	1,726	\$0.00	
Chariton	City	Sumner	142	\$0.00	
Chariton	City	Triplett	64	\$0.00	
<b>Christian</b>	<b>County</b>	<b>County-Wide</b>	<b>54,285</b>	<b>\$20,309.00</b>	<b>71.1</b>
Christian	City	Billings	1,091	\$0.00	
Christian	City	Clever	1,010	\$0.00	
Christian	City	Fremont Hills	597	\$0.00	
Christian	City	Highlandville	872	\$0.00	
Christian	City	Nixa	12,124	\$0.00	
Christian	City	Ozark	9,665	\$0.00	
Christian	City	Sparta	1,144	\$0.00	
<b>Clark</b>	<b>County</b>	<b>County-Wide</b>	<b>7,416</b>	<b>\$16,306.00</b>	<b>57.1</b>
Clark	City	Alexandria	166	\$0.00	
Clark	City	Kahoka	2,241	\$0.00	
Clark	Village	Luray	102	\$0.00	
Clark	Village	Revere	121	\$0.00	
Clark	City	Wayland	425	\$0.00	
Clark	City	Wyaconda	310	\$0.00	
<b>Clay</b>	<b>County</b>	<b>County-Wide</b>	<b>184,006</b>	<b>\$28,503.00</b>	<b>99.8</b>
Clay	City	Avondale	529	\$0.00	
Clay	Village	Birmingham	214	\$0.00	
Clay	Village	Claycomo	1,267	\$0.00	
Clay	City	Excelsior Estates	263	\$0.00	
Clay	City	Excelsior Springs	10,847	\$0.00	
Clay	City	Gladstone	26,365	\$0.00	
Clay	City	Glenaire	553	\$0.00	
Clay	City	Holt	405	\$0.00	
Clay	City	Kansas City	441,545	\$0.00	
Clay	City	Kearney	5,472	\$0.00	
Clay	City	Lawson	2,336	\$0.00	
Clay	City	Liberty	26,232	\$0.00	
Clay	City	Missouri City	295	\$0.00	
Clay	City	Mosby	242	\$0.00	

County	Community	Community Name	Population	Average Income	Per Capita Income
	Type		2000	Per Capita	% of US 1999
Clay	City	North Kansas City	4,714	\$0.00	
Clay	Village	Oaks	136	\$0.00	
Clay	Village	Oakview	386	\$0.00	
Clay	Village	Oakwood	197	\$0.00	
Clay	Village	Oakwood Park	183	\$0.00	
Clay	City	Pleasant Valley	3,321	\$0.00	
Clay	Village	Prathersville	111	\$0.00	
Clay	City	Randolph	47	\$0.00	
Clay	City	Smithville	5,514	\$0.00	
Clay	City	Sugar Creek	3,839	\$0.00	
<b>Clinton</b>	<b>County</b>	<b>County-Wide</b>	<b>18,979</b>	<b>\$23,210.00</b>	<b>81.3</b>
Clinton	City	Cameron	8,312	\$0.00	
Clinton	City	Lathrop	2,092	\$0.00	
Clinton	City	Plattsburg	2,354	\$0.00	
Clinton	City	Trimble	451	\$0.00	
Clinton	Village	Turney	155	\$0.00	
Clinton	City	Gower	1,399	\$0.00	
Clinton	City	Osborn	455	\$0.00	
<b>Cole</b>	<b>County</b>	<b>County-Wide</b>	<b>71,397</b>	<b>\$27,884.00</b>	<b>97.7</b>
Cole	Village	Centertown	257	\$0.00	
Cole	City	Jefferson City	39,636	\$0.00	
Cole	City	Lohman	168	\$0.00	
Cole	City	Russellville	758	\$0.00	
Cole	City	St. Martins	1,023	\$0.00	
Cole	City	St. Thomas	287	\$0.00	
Cole	City	Taos	870	\$0.00	
Cole	Village	Wardsville	976	\$0.00	
<b>Cooper</b>	<b>County</b>		<b>16,670</b>	<b>\$20,150.00</b>	<b>70.6</b>
Cooper	City	Blackwater	199	\$0.00	
Cooper	City	Boonville	8,202	\$0.00	
Cooper	City	Bunceton	348	\$0.00	
Cooper	City	Otterville	476	\$0.00	
Cooper	City	Pilot Grove	723	\$0.00	
Cooper	City	Prairie Home	220	\$0.00	
Cooper	Village	Wooldridge	47	\$0.00	
<b>Crawford</b>	<b>County</b>	<b>County-Wide</b>	<b>22,804</b>	<b>\$18,373.00</b>	<b>64.4</b>
Crawford	City	Bourbon	1,348	\$0.00	
Crawford	City	Cuba	3,230	\$0.00	
Crawford	Village	Leasburg	323	\$0.00	
Crawford		St. Cloud	56	\$0.00	
Crawford	City	Steelville	1,429	\$0.00	
Crawford	City	Sullivan	6,351	\$0.00	
<b>Dade</b>	<b>County</b>	<b>County-Wide</b>	<b>7,923</b>	<b>\$18,703.00</b>	<b>65.5</b>
Dade	Village	Arcola	45	\$0.00	

County	Community	Community Name	Population	Average Income	Per Capita Income
	Type		2000	Per Capita	% of US 1999
Dade	Village	Dadeville	224	\$0.00	
Dade	City	Everton	322	\$0.00	
Dade	City	Greenfield	1,358	\$0.00	
Dade	City	Lockwood	989	\$0.00	
Dade	Village	South Greenfield	136	\$0.00	
<b>Dallas</b>	<b>County</b>	<b>County-Wide</b>	<b>15,661</b>	<b>\$17,388.00</b>	<b>60.9</b>
Dallas	City	Buffalo	2,781	\$0.00	
Dallas	Village	Louisburg	147	\$0.00	
Dallas	City	Urbana	407	\$0.00	
<b>Daviess</b>	<b>County</b>	<b>County-Wide</b>	<b>8,016</b>	<b>\$18,323.00</b>	<b>64.2</b>
Daviess	Village	Altamont	218	\$0.00	
Daviess	City	Coffey	140	\$0.00	
Daviess	City	Gallatin	1,789	\$0.00	
Daviess	Village	Jameson	120	\$0.00	
Daviess	City	Jamesport	505	\$0.00	
Daviess	Village	Lock Springs	69	\$0.00	
Daviess	City	Pattonsburg	261	\$0.00	
Daviess	Village	Winston	247	\$0.00	
<b>DeKalb</b>	<b>County</b>	<b>County-Wide</b>	<b>11,597</b>	<b>\$14,969.00</b>	<b>52.4</b>
DeKalb	Village	Amity	70	\$0.00	
DeKalb	City	Clarksdale	351	\$0.00	
DeKalb	City	Maysville	1,212	\$0.00	
DeKalb	City	Osborn	455	\$0.00	
DeKalb	City	Stewartsville	759	\$0.00	
DeKalb	City	Union Star	433	\$0.00	
DeKalb	Village	Weatherby	123	\$0.00	
DeKalb	City	Cameron	8,312	\$0.00	
<b>Dent</b>	<b>County</b>	<b>County-Wide</b>	<b>14,927</b>	<b>\$18,900.00</b>	<b>66.2</b>
Dent	City	Bunker	427	\$0.00	
Dent	City	Salem	4,854	\$0.00	
<b>Douglas</b>	<b>County</b>	<b>County-Wide</b>	<b>13,084</b>	<b>\$15,393.00</b>	<b>53.9</b>
Douglas	City	Ava	3,021	\$0.00	
<b>Dunklin</b>	<b>County</b>	<b>County-Wide</b>	<b>33,155</b>	<b>\$19,007.00</b>	<b>66.6</b>
Dunklin	City	Arbyrd	528	\$0.00	
Dunklin	City	Campbell	1,883	\$0.00	
Dunklin	City	Cardwell	789	\$0.00	
Dunklin	City	Clarkton	1,330	\$0.00	
Dunklin	City	Holcomb	696	\$0.00	
Dunklin	City	Hornersville	686	\$0.00	
Dunklin	City	Kennett	11,260	\$0.00	
Dunklin	City	Malden	4,782	\$0.00	
Dunklin		Rives	88	\$0.00	
Dunklin	City	Senath	1,650	\$0.00	
<b>Franklin</b>	<b>County</b>	<b>County-Wide</b>	<b>93,807</b>	<b>\$24,007.00</b>	<b>84.1</b>

County	Community	Community Name	Population	Average Income	Per Capita Income
	Type		2000	Per Capita	% of US 1999
Franklin	City	Berger	206	\$0.00	
Franklin	City	Gerald	1,171	\$0.00	
Franklin	Village	Leslie	87	\$0.00	
Franklin	Village	Miramiguoa Park	127	\$0.00	
Franklin	City	New Haven	1,867	\$0.00	
Franklin	Village	Oak Grove (Franklin)	382	\$0.00	
Franklin	City	Pacific	5,482	\$0.00	
Franklin	Village	Parkway	280	\$0.00	
Franklin	City	St. Clair	4,390	\$0.00	
Franklin	City	Union	7,757	\$0.00	
Franklin	City	Washington	13,243	\$0.00	
Franklin	City	Sullivan	6,351	\$0.00	
<b>Gasconade</b>	<b>County</b>	<b>County-Wide</b>	<b>15,342</b>	<b>\$21,357.00</b>	<b>74.8</b>
Gasconade	City	Bland	565	\$0.00	
Gasconade	City	Gasconade	267	\$0.00	
Gasconade	City	Hermann	2,674	\$0.00	
Gasconade	City	Morrison	123	\$0.00	
Gasconade	City	Owensville	2,500	\$0.00	
Gasconade	City	Rosebud	364	\$0.00	
<b>Gentry</b>	<b>County</b>	<b>County-Wide</b>	<b>6,861</b>	<b>\$19,983.00</b>	<b>66.5</b>
Gentry	City	Albany	1,937	\$0.00	
Gentry	City	Darlington	113	\$0.00	
Gentry	Village	Gentry	101	\$0.00	
Gentry	City	King City	1,012	\$0.00	
Gentry	Village	McFall	135	\$0.00	
Gentry	City	Stanberry	1,243	\$0.00	
<b>Greene</b>	<b>County</b>	<b>County-Wide</b>	<b>240,391</b>	<b>\$26,496.00</b>	<b>92.8</b>
Greene	City	Ash Grove	1,430	\$0.00	
Greene	City	Battlefield	2,385	\$0.00	
Greene	Village	Brookline	326	\$0.00	
Greene	City	Fair Grove	1,107	\$0.00	
Greene	City	Republic	8,438	\$0.00	
Greene	City	Springfield	151,580	\$0.00	
Greene	City	Strafford	1,845	\$0.00	
Greene	City	Walnut Grove	630	\$0.00	
Greene	City	Willard	3,193	\$0.00	
Greene	City	Rogersville	1,508	\$0.00	
<b>Grundy</b>	<b>County</b>	<b>County-Wide</b>	<b>10,432</b>	<b>\$20,802.00</b>	<b>72.9</b>
Grundy	Village	Brimson	63	\$0.00	
Grundy	City	Galt	275	\$0.00	
Grundy	City	Laredo	250	\$0.00	
Grundy	City	Spickard	315	\$0.00	
Grundy	City	Tindall	65	\$0.00	
Grundy	City	Trenton	6,216	\$0.00	

County	Community	Community Name	Population	Average Income	Per Capita Income
	Type		2000	Per Capita	% of US 1999
<b>Harrison</b>	<b>County</b>	<b>County-Wide</b>	<b>8,850</b>	<b>\$19,502.00</b>	<b>68.3</b>
Harrison	City	Bethany	3,087	\$0.00	
Harrison	Village	Blythedale	233	\$0.00	
Harrison	City	Cainsville	370	\$0.00	
Harrison	Village	Eagleville	321	\$0.00	
Harrison	City	Gilman City	380	\$0.00	
Harrison	Village	Mount Moriah	143	\$0.00	
Harrison	City	New Hampton	349	\$0.00	
Harrison	City	Ridgeway	530	\$0.00	
<b>Henry</b>	<b>County</b>	<b>County-Wide</b>	<b>21,997</b>	<b>\$20,120.00</b>	<b>70.5</b>
Henry	City	Blairstown	141	\$0.00	
Henry	City	Brownington	119	\$0.00	
Henry	City	Calhoun	491	\$0.00	
Henry	City	Clinton	9,311	\$0.00	
Henry	City	Deepwater	507	\$0.00	
Henry		Hartwell	16	\$0.00	
Henry		La Due	39	\$0.00	
Henry	City	Montrose	417	\$0.00	
Henry	Village	Tightwad	63	\$0.00	
Henry	City	Urich	499	\$0.00	
Henry	City	Windsor	3,087	\$0.00	
<b>Hickory</b>	<b>County</b>	<b>County-Wide</b>	<b>8,940</b>	<b>\$14,951.00</b>	<b>52.4</b>
Hickory	City	Cross Timbers	185	\$0.00	
Hickory	City	Hermitage	406	\$0.00	
Hickory	Village	Preston	113	\$0.00	
Hickory	City	Weaubleau	518	\$0.00	
Hickory	City	Wheatland	388	\$0.00	
<b>Holt</b>	<b>County</b>	<b>County-Wide</b>	<b>5,351</b>	<b>\$20,370.00</b>	<b>71.4</b>
Holt	Village	Bigelow	38	\$0.00	
Holt	Village	Big Lake	127	\$0.00	
Holt	Village	Corning	21	\$0.00	
Holt	City	Craig	309	\$0.00	
Holt	City	Forest City	338	\$0.00	
Holt	Village	Fortescue	51	\$0.00	
Holt	City	Maitland	342	\$0.00	
Holt	City	Mound City	1,193	\$0.00	
Holt	City	Oregon	935	\$0.00	
<b>Howard</b>	<b>County</b>	<b>County-Wide</b>	<b>10,212</b>	<b>\$20,114.00</b>	<b>70.5</b>
Howard	City	Armstrong	287	\$0.00	
Howard	City	Fayette	2,793	\$0.00	
Howard	City	Franklin	112	\$0.00	
Howard	City	Glasgow	1,263	\$0.00	
Howard	City	New Franklin	1,145	\$0.00	
<b>Howell</b>	<b>County</b>	<b>County-Wide</b>	<b>37,238</b>	<b>\$18,420.00</b>	<b>64.5</b>



County	Community	Community Name	Population	Average Income	Per Capita Income
	Type		2000	Per Capita	% of US 1999
Howell	City	Brandsville	174	\$0.00	
Howell	City	Mountain View	2,430	\$0.00	
Howell	City	West Plains	10,866	\$0.00	
Howell	City	Willow Springs	2,147	\$0.00	
<b>Iron</b>	<b>County</b>	<b>County-Wide</b>	<b>10,697</b>	<b>\$16,619.00</b>	<b>58.2</b>
Iron	City	Annapolis	310	\$0.00	
Iron	City	Arcadia	567	\$0.00	
Iron	City	Des Arc	187	\$0.00	
Iron	City	Ironton	1,471	\$0.00	
Iron	City	Pilot Knob	697	\$0.00	
Iron	City	Viburnum	825	\$0.00	
<b>Jackson</b>	<b>County</b>	<b>County-Wide</b>	<b>654,880</b>	<b>\$28,258.00</b>	<b>99</b>
Jackson	City	Blue Springs	48,080	\$0.00	
Jackson	City	Buckner	2,725	\$0.00	
Jackson	City	Grain Valley	5,160	\$0.00	
Jackson	City	Grandview	24,881	\$0.00	
Jackson	City	Greenwood	3,952	\$0.00	
Jackson	City	Independence	113,288	\$0.00	
Jackson	City	Lake Lotawana	1,872	\$0.00	
Jackson	City	Lake Tapawingo	843	\$0.00	
Jackson	City	Levasy	108	\$0.00	
Jackson	City	Lone Jack	528	\$0.00	
Jackson	City	Oak Grove (Jackson)	5,535	\$0.00	
Jackson	City	Raytown	30,388	\$0.00	
Jackson	Village	River Bend	10	\$0.00	
Jackson	Village	Sibley	347	\$0.00	
Jackson	City	Sugar Creek	3,839	\$0.00	
Jackson	Village	Unity Village	140	\$0.00	
Jackson	City	Kansas City	441,545	\$0.00	
Jackson	City	Lee's Summit	70,700	\$0.00	
<b>Jasper</b>	<b>County</b>	<b>County-Wide</b>	<b>104,686</b>	<b>\$22,865.00</b>	<b>80.1</b>
Jasper	Village	Airport Drive	622	\$0.00	
Jasper	City	Alba	588	\$0.00	
Jasper	City	Asbury	218	\$0.00	
Jasper	Village	Avilla	137	\$0.00	
Jasper	Village	Brooklyn Heights	125	\$0.00	
Jasper	City	Carl Junction	5,294	\$0.00	
Jasper	City	Cartersville	1,850	\$0.00	
Jasper	City	Carthage	12,668	\$0.00	
Jasper	Village	Carytown	217	\$0.00	
Jasper	City	Duenweg	1,034	\$0.00	
Jasper	Village	Duquesne	1,640	\$0.00	
Jasper	Village	Fidelity	252	\$0.00	
Jasper	City	Jasper	1,011	\$0.00	

County	Community	Community Name	Population	Average Income	Per Capita Income
	Type		2000	Per Capita	% of US 1999
Jasper	City	Joplin	45,504	\$0.00	
Jasper	Village	La Russell	138	\$0.00	
Jasper	City	Neck City	119	\$0.00	
Jasper	City	Oronogo	976	\$0.00	
Jasper	City	Purcell	357	\$0.00	
Jasper	Village	Reeds	103	\$0.00	
Jasper	City	Sarcoxie	1,354	\$0.00	
Jasper	City	Waco	86	\$0.00	
Jasper	City	Webb City	9,812	\$0.00	
<b>Jefferson</b>	<b>County</b>	<b>County-Wide</b>	<b>198,099</b>	<b>\$21,600.00</b>	<b>75.7</b>
Jefferson	City	Arnold	19,965	\$0.00	
Jefferson	City	Byrnes Mill	2,376	\$0.00	
Jefferson	Village	Cedar Hill Lakes	229	\$0.00	
Jefferson	City	Crystal City	4,247	\$0.00	
Jefferson	City	De Soto	6,375	\$0.00	
Jefferson	City	Festus	9,660	\$0.00	
Jefferson	City	Herculaneum	2,805	\$0.00	
Jefferson	City	Hillsboro	1,675	\$0.00	
Jefferson	City	Kimmswick	94	\$0.00	
Jefferson	City	Olympian Village	669	\$0.00	
Jefferson	Village	Parkdale	205	\$0.00	
Jefferson	City	Pevely	3,768	\$0.00	
Jefferson	Village	Scotsdale	211	\$0.00	
Jefferson	City	Pacific	5,482	\$0.00	
<b>Johnson</b>	<b>County</b>	<b>County-Wide</b>	<b>48,258</b>	<b>\$19,365.00</b>	<b>67.8</b>
Johnson	City	Centerview	249	\$0.00	
Johnson	City	Chilhowee	329	\$0.00	
Johnson	City	Holden	2,510	\$0.00	
Johnson	City	Kingsville	257	\$0.00	
Johnson	City	Knob Noster	2,462	\$0.00	
Johnson	Village	La Tour	65	\$0.00	
Johnson	City	Leeton	619	\$0.00	
Johnson	City	Warrensburg	16,340	\$0.00	
<b>Knox</b>	<b>County</b>	<b>County-Wide</b>	<b>4,361</b>	<b>\$17,133.00</b>	<b>60</b>
Knox	City	Baring	159	\$0.00	
Knox	City	Edina	1,233	\$0.00	
Knox	City	Hurdland	239	\$0.00	
Knox	City	Knox City	223	\$0.00	
Knox	Village	Newark	100	\$0.00	
Knox	City	Novelty	119	\$0.00	
<b>Laclede</b>	<b>County</b>	<b>County-Wide</b>	<b>32,513</b>	<b>\$19,473.00</b>	<b>68.2</b>
Laclede	City	Conway	743	\$0.00	
Laclede	City	Lebanon	12,155	\$0.00	
Laclede	Village	Phillipsburg	201	\$0.00	

County	Community	Community Name	Population	Average Income	Per Capita Income
	Type		2000	Per Capita	% of US 1999
Laclede	Village	Twin Bridges	42	\$0.00	
Laclede	City	Richland	1,805	\$0.00	
Laclede	City	Stoutland	177	\$0.00	
<b>Lafayette</b>	<b>County</b>	<b>County-Wide</b>	<b>32,960</b>	<b>\$22,445.00</b>	<b>78.6</b>
Lafayette	City	Alma	399	\$0.00	
Lafayette	Village	Aullville	86	\$0.00	
Lafayette	City	Bates City	245	\$0.00	
Lafayette	City	Blackburn	284	\$0.00	
Lafayette	City	Concordia	2,360	\$0.00	
Lafayette	City	Corder	427	\$0.00	
Lafayette	Village	Dover	108	\$0.00	
Lafayette	City	Emma	243	\$0.00	
Lafayette	City	Higginsville	4,682	\$0.00	
Lafayette	City	Lake Lafayette	346	\$0.00	
Lafayette	City	Lexington	4,453	\$0.00	
Lafayette	City	Mayview	294	\$0.00	
Lafayette	City	Napoleon	208	\$0.00	
Lafayette	City	Odessa	4,818	\$0.00	
Lafayette	City	Waverly	806	\$0.00	
Lafayette	City	Wellington	784	\$0.00	
Lafayette	City	Oak Grove (Jackson)	5,535	\$0.00	
<b>Lawrence</b>	<b>County</b>	<b>County-Wide</b>	<b>35,204</b>	<b>\$17,882.00</b>	<b>62.6</b>
Lawrence	City	Aurora	7,014	\$0.00	
Lawrence	Village	Freistatt	184	\$0.00	
Lawrence	Village	Halltown	189	\$0.00	
Lawrence	Village	Hoberg	60	\$0.00	
Lawrence	City	Marionville	2,113	\$0.00	
Lawrence	City	Miller	754	\$0.00	
Lawrence	City	Mount Vernon	4,017	\$0.00	
Lawrence	City	Pierce City	1,385	\$0.00	
Lawrence	City	Stotts City	250	\$0.00	
Lawrence	City	Verona	714	\$0.00	
Lawrence	City	Monett	7,396	\$0.00	
<b>Lewis</b>	<b>County</b>	<b>County-Wide</b>	<b>10,494</b>	<b>\$16,965.00</b>	<b>59.4</b>
Lewis	City	Canton	2,557	\$0.00	
Lewis	City	Ewing	464	\$0.00	
Lewis	City	La Belle	669	\$0.00	
Lewis	City	La Grange	1,000	\$0.00	
Lewis	City	Lewistown	595	\$0.00	
Lewis	Village	Monticello	126	\$0.00	
<b>Lincoln</b>	<b>County</b>	<b>County-Wide</b>	<b>38,944</b>	<b>\$21,685.00</b>	<b>76</b>
Lincoln		Cave	7	\$0.00	
Lincoln	Village	Chain of Rocks	91	\$0.00	
Lincoln	City	Elsberry	2,047	\$0.00	

County	Community	Community Name	Population	Average Income	Per Capita Income
	Type		2000	Per Capita	% of US 1999
Lincoln	City	Foley	178	\$0.00	
Lincoln	Village	Fountain N' Lakes	129	\$0.00	
Lincoln	City	Hawk Point	459	\$0.00	
Lincoln	City	Moscow Mills	1,742	\$0.00	
Lincoln	City	Old Monroe	250	\$0.00	
Lincoln	Village	Silex	206	\$0.00	
Lincoln	City	Troy	6,737	\$0.00	
Lincoln	Village	Truxton	96	\$0.00	
Lincoln	Village	Whiteside	67	\$0.00	
Lincoln	City	Winfield	723	\$0.00	
<b>Linn</b>	<b>County</b>	<b>County-Wide</b>	<b>13,754</b>	<b>\$20,038.00</b>	<b>70.2</b>
Linn	City	Brookfield	4,769	\$0.00	
Linn	City	Browning	317	\$0.00	
Linn	City	Bucklin	524	\$0.00	
Linn	City	Laclede	415	\$0.00	
Linn	City	Linneus	369	\$0.00	
Linn	City	Meadville	457	\$0.00	
Linn	City	Purdin	223	\$0.00	
Linn	City	Marceline	2,558	\$0.00	
<b>Livingston</b>	<b>County</b>		<b>14,558</b>	<b>\$24,013.00</b>	<b>84.1</b>
Livingston	City	Chillicothe	8,968	\$0.00	
Livingston	City	Chula	198	\$0.00	
Livingston	Village	Ludlow	204	\$0.00	
Livingston	Village	Mooreville	89	\$0.00	
Livingston	Village	Utica	274	\$0.00	
Livingston	City	Wheeling	268	\$0.00	
<b>Macon</b>	<b>County</b>	<b>County-Wide</b>	<b>15,762</b>	<b>\$19,163.00</b>	<b>67.1</b>
Macon	City	Atlanta	450	\$0.00	
Macon	City	Bevier	723	\$0.00	
Macon	City	Callao	291	\$0.00	
Macon	City	Elmer	98	\$0.00	
Macon	City	Ethel	100	\$0.00	
Macon	City	La Plata	1,486	\$0.00	
Macon	City	Macon	5,538	\$0.00	
Macon	City	New Cambria	222	\$0.00	
Macon	Village	South Gifford	72	\$0.00	
<b>Madison</b>	<b>County</b>	<b>County-Wide</b>	<b>11,800</b>	<b>\$17,498.00</b>	<b>61.3</b>
Madison	Village	Cobalt	189	\$0.00	
Madison	City	Fredericktown	3,928	\$0.00	
Madison	Village	Junction City	319	\$0.00	
Madison	City	Marquand	251	\$0.00	
<b>Maries</b>	<b>County</b>	<b>County-Wide</b>	<b>8,903</b>	<b>\$17,648.00</b>	<b>61.8</b>
Maries	Village	Argyle	164	\$0.00	
Maries	City	Belle	1,344	\$0.00	

County	Community	Community Name	Population	Average Income	Per Capita Income
	Type		2000	Per Capita	% of US 1999
Marion	City	Vienna	628	\$0.00	
<b>Marion</b>	<b>County</b>	<b>County-Wide</b>	<b>28,289</b>	<b>\$22,188.00</b>	<b>77.7</b>
Marion/Ralls	City	Hannibal	17,757	\$0.00	
Marion/Monroe	City	Monroe City	2,588	\$0.00	
Marion	City	Palmyra	3,467	\$0.00	
<b>McDonald</b>	<b>County</b>	<b>County-Wide</b>	<b>21,681</b>	<b>\$16,850.00</b>	<b>59</b>
McDonald	City	Anderson	1,856	\$0.00	
McDonald	City	Goodman	1,183	\$0.00	
McDonald	City	Lanagan	411	\$0.00	
McDonald	City	Noel	1,480	\$0.00	
McDonald	City	Pineville	768	\$0.00	
McDonald	City	South West City	855	\$0.00	
<b>Mercer</b>	<b>County</b>	<b>County-Wide</b>	<b>3,757</b>	<b>\$15,737.00</b>	<b>55.1</b>
Mercer	City	Mercer	342	\$0.00	
Mercer	City	Princeton	1,047	\$0.00	
Mercer	Village	South Lineville	37	\$0.00	
<b>Miller</b>	<b>County</b>	<b>County-Wide</b>	<b>23,564</b>	<b>\$17,833.00</b>	<b>62.5</b>
Miller	City	Bagnell	86	\$0.00	
Miller	Village	Brumley	102	\$0.00	
Miller	City	Eldon	4,895	\$0.00	
Miller	City	Iberia	605	\$0.00	
Miller	City	Lakeside	37	\$0.00	
Miller	City	Osage Beach	3,662	\$0.00	
Miller	Village	Olean	157	\$0.00	
Miller	Village	St. Elizabeth	297	\$0.00	
Miller	Village	Tuscumbia	218	\$0.00	
Miller	City	Lake Ozark	1,489	\$0.00	
<b>Mississippi</b>	<b>County</b>	<b>County-Wide</b>	<b>13,427</b>	<b>\$18,681.00</b>	<b>65.4</b>
Mississippi	City	Anniston	285	\$0.00	
Mississippi	City	Bertrand	740	\$0.00	
Mississippi	City	Charleston	4,732	\$0.00	
Mississippi	City	East Prairie	3,227	\$0.00	
Mississippi	Village	Pinhook	48	\$0.00	
Mississippi	Village	Wilson City	165	\$0.00	
Mississippi	City	Wyatt	364	\$0.00	
Mississippi/Scott	City	Miner	1,056	\$0.00	
<b>Moniteau</b>	<b>County</b>	<b>County-Wide</b>	<b>14,827</b>	<b>\$20,452.00</b>	<b>71.6</b>
Moniteau	City	California	4,005	\$0.00	
Moniteau	City	Clarksburg	375	\$0.00	
Moniteau	City	Jamestown	382	\$0.00	
Moniteau	City	Lupus	29	\$0.00	
Moniteau	City	Tipton	3,261	\$0.00	
<b>Monroe</b>	<b>County</b>	<b>County-Wide</b>	<b>9,311</b>	<b>\$18,945.00</b>	<b>66.4</b>
Monroe		Florida	9	\$0.00	

County	Community	Community Name	Population	Average Income	Per Capita Income
	Type		2000	Per Capita	% of US 1999
Monroe	Village	Holliday	129	\$0.00	
Monroe	City	Madison	586	\$0.00	
Monroe	City	Paris	1,529	\$0.00	
Monroe	Village	Stoutsville	44	\$0.00	
Monroe	City	Monroe City	2,588	\$0.00	
<b>Montgomery</b>	<b>County</b>	<b>County-Wide</b>	<b>12,136</b>	<b>\$20,094.00</b>	<b>70.4</b>
Montgomery	City	Bellflower	427	\$0.00	
Montgomery	City	High Hill	231	\$0.00	
Montgomery	City	Jonesburg	695	\$0.00	
Montgomery	City	McKittrick	72	\$0.00	
Montgomery	City	Middletown	199	\$0.00	
Montgomery	City	Montgomery City	2,442	\$0.00	
Montgomery	City	New Florence	764	\$0.00	
Montgomery	Village	Rhineland	176	\$0.00	
Montgomery	City	Wellsville	1,423	\$0.00	
<b>Morgan</b>	<b>County</b>	<b>County-Wide</b>	<b>19,309</b>	<b>\$18,091.00</b>	<b>63.4</b>
Morgan	City	Barnett	207	\$0.00	
Morgan	Village	Gravois Mills	208	\$0.00	
Morgan	Village	Laurie	663	\$0.00	
Morgan	City	Stover	968	\$0.00	
Morgan	City	Syracuse	172	\$0.00	
Morgan	City	Versailles	2,565	\$0.00	
Morgan	Village	Sunrise Beach	368	\$0.00	
<b>New Madrid</b>	<b>County</b>	<b>County-Wide</b>	<b>19,760</b>	<b>\$17,862.00</b>	<b>62.6</b>
New Madrid	City	Canalou	348	\$0.00	
New Madrid	City	Catron	68	\$0.00	
New Madrid	City	Gideon	1,113	\$0.00	
New Madrid	City	Howardville	342	\$0.00	
New Madrid	City	Lilbourn	1,303	\$0.00	
New Madrid	City	Marston	610	\$0.00	
New Madrid	City	Matthews	605	\$0.00	
New Madrid	City	Morehouse	1,015	\$0.00	
New Madrid	City	New Madrid	3,334	\$0.00	
New Madrid	Village	North Lilbourn	95	\$0.00	
New Madrid	City	Parma	852	\$0.00	
New Madrid	City	Portageville	3,295	\$0.00	
New Madrid	City	Risco	392	\$0.00	
New Madrid	City	Sikeston	16,992	\$0.00	
New Madrid	Village	Tallapoosa	204	\$0.00	
<b>Newton</b>	<b>County</b>	<b>County-Wide</b>	<b>52,636</b>	<b>\$21,587.00</b>	<b>75.6</b>
Newton	Village	Cliff Village	33	\$0.00	
Newton	Village	Dennis Acres	68	\$0.00	
Newton	City	Diamond	807	\$0.00	
Newton	City	Fairview	395	\$0.00	

County	Community	Community Name	Population	Average Income	Per Capita Income
	Type		2000	Per Capita	% of US 1999
Newton	City	Granby	2,121	\$0.00	
Newton	Village	Grand Falls Plaza	104	\$0.00	
Newton	City	Joplin	45,504	\$0.00	
Newton	Village	Leawood	904	\$0.00	
Newton	Village	Loma Linda	507	\$0.00	
Newton	City	Neosho	10,505	\$0.00	
Newton	Village	Newtonia	231	\$0.00	
Newton	Village	Redings Mill	159	\$0.00	
Newton	Village	Ritchey	76	\$0.00	
Newton	Village	Saginaw	276	\$0.00	
Newton	City	Seneca	2,135	\$0.00	
Newton	Village	Shoal Creek Drive	346	\$0.00	
Newton	Village	Shoal Creek Estates	51	\$0.00	
Newton	Village	Silver Creek	608	\$0.00	
Newton	Village	Stark City	156	\$0.00	
Newton	Village	Stella	178	\$0.00	
Newton	Village	Wentworth	141	\$0.00	
<b>Nodaway</b>	<b>County</b>	<b>County-Wide</b>	<b>21,912</b>	<b>\$19,958.00</b>	<b>69.9</b>
Nodaway	Village	Arkoe	58	\$0.00	
Nodaway	City	Barnard	257	\$0.00	
Nodaway	City	Burlington Junction	632	\$0.00	
Nodaway	City	Clearmont	191	\$0.00	
Nodaway	Village	Clyde	74	\$0.00	
Nodaway	City	Conception Junction	202	\$0.00	
Nodaway	City	Elmo	166	\$0.00	
Nodaway	City	Graham	191	\$0.00	
Nodaway	Village	Guilford	87	\$0.00	
Nodaway	City	Hopkins	579	\$0.00	
Nodaway	City	Maryville	10,581	\$0.00	
Nodaway	City	Parnell	197	\$0.00	
Nodaway	Village	Pickering	154	\$0.00	
Nodaway	City	Quitman	46	\$0.00	
Nodaway	City	Ravenwood	448	\$0.00	
Nodaway	City	Skidmore	342	\$0.00	
<b>Oregon</b>	<b>County</b>	<b>County-Wide</b>	<b>10,344</b>	<b>\$14,930.00</b>	<b>52.3</b>
Oregon	City	Alton	668	\$0.00	
Oregon	City	Koshkonong	205	\$0.00	
Oregon	City	Thayer	2,201	\$0.00	
<b>Osage</b>	<b>County</b>	<b>County-Wide</b>	<b>13,062</b>	<b>\$23,143.00</b>	<b>81.1</b>
Osage	Village	Argyle	164	\$0.00	
Osage	City	Belle	1,344	\$0.00	
Osage	City	Chamois	456	\$0.00	
Osage	Village	Freeburg	423	\$0.00	
Osage	City	Linn	1,354	\$0.00	

County	Community	Community Name	Population	Average Income	Per Capita Income
	Type		2000	Per Capita	% of US 1999
Osage	City	Meta	249	\$0.00	
Osage	City	Westphalia	320	\$0.00	
<b>Ozark</b>	<b>County</b>	<b>County-Wide</b>	<b>9,542</b>	<b>\$14,563.00</b>	<b>51</b>
Ozark	Village	Bakersfield	285	\$0.00	
Ozark	City	Gainesville	632	\$0.00	
Ozark	Village	Sundown	38	\$0.00	
Ozark	Village	Theodosia	240	\$0.00	
<b>Pemiscot</b>	<b>County</b>	<b>County-Wide</b>	<b>20,047</b>	<b>\$17,388.00</b>	<b>60.9</b>
Pemiscot	City	Bragg City	189	\$0.00	
Pemiscot	City	Caruthersville	6,760	\$0.00	
Pemiscot	City	Cooter	440	\$0.00	
Pemiscot	City	Hayti	3,207	\$0.00	
Pemiscot	City	Hayti Heights	771	\$0.00	
Pemiscot	Village	Hayward	123	\$0.00	
Pemiscot	City	Holland	246	\$0.00	
Pemiscot	City	Homestown	181	\$0.00	
Pemiscot	Village	North Wardell	170	\$0.00	
Pemiscot	Village	Pascola	138	\$0.00	
Pemiscot	City	Steele	2,263	\$0.00	
Pemiscot	City	Wardell	278	\$0.00	
<b>Perry</b>	<b>County</b>	<b>County-Wide</b>	<b>18,132</b>	<b>\$21,923.00</b>	<b>76.8</b>
Perry	City	Altenburg	309	\$0.00	
Perry		Biehle	11	\$0.00	
Perry	City	Frohna	192	\$0.00	
Perry		Lithium	0	\$0.00	
Perry	Village	Longtown	76	\$0.00	
Perry	City	Perryville	7,667	\$0.00	
<b>Pettis</b>	<b>County</b>	<b>County-Wide</b>	<b>39,403</b>	<b>\$23,018.00</b>	<b>80.6</b>
Pettis	City	Green Ridge	445	\$0.00	
Pettis	City	Houstonia	275	\$0.00	
Pettis	Village	Hughesville	174	\$0.00	
Pettis	City	La Monte	1,064	\$0.00	
Pettis	City	Sedalia	20,339	\$0.00	
Pettis	City	Smithton	510	\$0.00	
Pettis	Village	Ionia	108	\$0.00	
Pettis	City	Windsor	3,087	\$0.00	
<b>Phelps</b>	<b>County</b>	<b>County-Wide</b>	<b>39,825</b>	<b>\$21,041.00</b>	<b>73.7</b>
Phelps	City	Doolittle	644	\$0.00	
Phelps	City	Edgar Springs	190	\$0.00	
Phelps	City	Newburg	484	\$0.00	
Phelps	City	Rolla	16,367	\$0.00	
Phelps	City	St. James	3,704	\$0.00	
<b>Pike</b>	<b>County</b>	<b>County-Wide</b>	<b>18,351</b>	<b>\$19,651.00</b>	<b>68.8</b>
Pike	Village	Annada	48	\$0.00	



County	Community	Community Name	Population	Average Income	Per Capita Income
	Type		2000	Per Capita	% of US 1999
Pike		Ashburn	51	\$0.00	
Pike	City	Bowling Green	3,260	\$0.00	
Pike	City	Clarksville	490	\$0.00	
Pike	City	Curryville	251	\$0.00	
Pike	Village	Eolia	435	\$0.00	
Pike	City	Frankford	351	\$0.00	
Pike	City	Louisiana	3,863	\$0.00	
Pike	Village	Paynesville	91	\$0.00	
Pike	Village	Tarrants	30	\$0.00	
<b>Platte</b>	<b>County</b>	<b>County-Wide</b>	<b>73,781</b>	<b>\$32,753.00</b>	<b>114.7</b>
Platte	City	Camden Point	484	\$0.00	
Platte	City	Dearborn	529	\$0.00	
Platte	City	Edgerton	533	\$0.00	
Platte	Village	Farley	226	\$0.00	
Platte	Village	Ferrelview	593	\$0.00	
Platte	City	Houston Lake	284	\$0.00	
Platte	Village	Iatan	54	\$0.00	
Platte	City	Lake Waukomis	917	\$0.00	
Platte	City	Northmoor	399	\$0.00	
Platte	City	Parkville	4,059	\$0.00	
Platte	City	Platte City	3,866	\$0.00	
Platte	City	Platte Woods	474	\$0.00	
Platte	Village	Ridgely	64	\$0.00	
Platte	City	Riverside	2,979	\$0.00	
Platte	City	Tracy	213	\$0.00	
Platte	City	Weatherby Lake	1,873	\$0.00	
Platte	City	Weston	1,631	\$0.00	
Platte	City	Kansas City	441,545	\$0.00	
<b>Polk</b>	<b>County</b>	<b>County-Wide</b>	<b>26,992</b>	<b>\$17,624.00</b>	<b>61.7</b>
Polk	Village	Aldrich	75	\$0.00	
Polk	City	Bolivar	9,143	\$0.00	
Polk	City	Fair Play	418	\$0.00	
Polk	Village	Flemington	124	\$0.00	
Polk	Village	Halfway	176	\$0.00	
Polk	City	Humansville	946	\$0.00	
Polk	City	Morrisville	344	\$0.00	
Polk	City	Pleasant Hope	548	\$0.00	
<b>Pulaski</b>	<b>County</b>	<b>County-Wide</b>	<b>41,165</b>	<b>\$23,039.00</b>	<b>80.7</b>
Pulaski	City	Crocker	1,033	\$0.00	
Pulaski	City	Dixon	1,570	\$0.00	
Pulaski	City	Richland	1,805	\$0.00	
Pulaski	City	St. Robert	2,760	\$0.00	
Pulaski	City	Waynesville	3,507	\$0.00	
<b>Putnam</b>	<b>County</b>	<b>County-Wide</b>	<b>5,223</b>	<b>\$16,976.00</b>	<b>59.5</b>

County	Community	Community Name	Population	Average Income	Per Capita Income
	Type		2000	Per Capita	% of US 1999
Putnam	Village	Livonia	114	\$0.00	
Putnam	Village	Lucerne	92	\$0.00	
Putnam	City	Powersville	86	\$0.00	
Putnam	City	Unionville	2,041	\$0.00	
Putnam		Worthington	89	\$0.00	
<b>Ralls</b>	<b>County</b>	<b>County-Wide</b>	<b>9,626</b>	<b>\$20,047.00</b>	<b>70.2</b>
Ralls	City	Center	644	\$0.00	
Ralls	City	New London	1,001	\$0.00	
Ralls	City	Perry	666	\$0.00	
Ralls/Marion	City	Hannibal	17,757	\$0.00	
Ralls/Monroe	City	Monroe City	2,588	\$0.00	
Ralls	Village	Rensselaer	145	\$0.00	
<b>Randolph</b>	<b>County</b>	<b>County-Wide</b>	<b>24,663</b>	<b>\$19,448.00</b>	<b>68.1</b>
Randolph	Village	Cairo	293	\$0.00	
Randolph	City	Clark	275	\$0.00	
Randolph	City	Clifton Hill	124	\$0.00	
Randolph	City	Higbee	623	\$0.00	
Randolph	City	Huntsville	1,553	\$0.00	
Randolph	Village	Jacksonville	163	\$0.00	
Randolph	City	Moberly	11,945	\$0.00	
Randolph	Village	Renick	221	\$0.00	
<b>Ray</b>	<b>County</b>	<b>County-Wide</b>	<b>23,354</b>	<b>\$20,005.00</b>	<b>70.1</b>
Ray	City	Camden	209	\$0.00	
Ray	City	Crystal Lakes	383	\$0.00	
Ray	Village	Elmira	82	\$0.00	
Ray	City	Fleming	122	\$0.00	
Ray	City	Hardin	614	\$0.00	
Ray	City	Henrietta	457	\$0.00	
Ray		Homestead	181	\$0.00	
Ray	City	Orrick	889	\$0.00	
Ray	Village	Rayville	204	\$0.00	
Ray	City	Richmond	6,116	\$0.00	
Ray	City	Woods Heights	742	\$0.00	
Ray	City	Excelsior Estates	263	\$0.00	
Ray	City	Excelsior Springs	10,847	\$0.00	
Ray	City	Lawson	2,336	\$0.00	
<b>Reynolds</b>	<b>County</b>	<b>County-Wide</b>	<b>6,689</b>	<b>\$16,395.00</b>	<b>57.4</b>
Reynolds	City	Centerville	171	\$0.00	
Reynolds	City	Ellington	1,045	\$0.00	
Reynolds	City	Bunker	427	\$0.00	
<b>Ripley</b>	<b>County</b>	<b>County-Wide</b>	<b>13,509</b>	<b>\$14,199.00</b>	<b>49.7</b>
Ripley	City	Doniphan	1,932	\$0.00	
Ripley	City	Naylor	610	\$0.00	
<b>Saline</b>	<b>County</b>	<b>County-Wide</b>	<b>23,756</b>	<b>\$22,556.00</b>	<b>79</b>

County	Community	Community Name	Population	Average Income	Per Capita Income
	Type		2000	Per Capita	% of US 1999
Saline	Village	Arrow Rock	79	\$0.00	
Saline	City	Gilliam	229	\$0.00	
Saline	Village	Grand Pass	53	\$0.00	
Saline	City	Malta Bend	249	\$0.00	
Saline	City	Marshall	12,433	\$0.00	
Saline	City	Miami	160	\$0.00	
Saline	Village	Mount Leonard	123	\$0.00	
Saline	City	Nelson	212	\$0.00	
Saline	City	Slater	2,083	\$0.00	
Saline	City	Sweet Springs	1,628	\$0.00	
Saline	City	Blackburn	284	\$0.00	
Saline	City	Emma	243	\$0.00	
<b>Schuyler</b>	<b>County</b>	<b>County-Wide</b>	<b>4,170</b>	<b>\$14,773.00</b>	<b>51.8</b>
Schuyler	City	Downing	396	\$0.00	
Schuyler	Village	Glenwood	203	\$0.00	
Schuyler	City	Lancaster	737	\$0.00	
Schuyler	City	Queen City	638	\$0.00	
Schuyler	City	Greentop	427	\$0.00	
<b>Scotland</b>	<b>County</b>	<b>County-Wide</b>	<b>4,983</b>	<b>\$18,429.00</b>	<b>64.6</b>
Scotland	Village	Arbela	40	\$0.00	
Scotland	Village	Granger	44	\$0.00	
Scotland	City	Memphis	2,061	\$0.00	
Scotland	Village	Rutledge	103	\$0.00	
Scotland	City	South Gorin	143	\$0.00	
<b>Scott</b>	<b>County</b>	<b>County-Wide</b>	<b>40,422</b>	<b>\$20,813.00</b>	<b>72.9</b>
Scott	City	Benton	732	\$0.00	
Scott	Village	Blodgett	265	\$0.00	
Scott	City	Chaffee	3,044	\$0.00	
Scott	City	Commerce	110	\$0.00	
Scott	Village	Diehlstadt	163	\$0.00	
Scott	Village	Haywood City	239	\$0.00	
Scott	Village	Kelso	527	\$0.00	
Scott		Lambert	49	\$0.00	
Scott/Mississippi	City	Miner	1,056	\$0.00	
Scott	City	Morley	792	\$0.00	
Scott	City	Oran	1,264	\$0.00	
Scott	City	Scott City	4,591	\$0.00	
Scott	Village	Vanduser	217	\$0.00	
Scott	City	Sikeston	16,992	\$0.00	
<b>Shannon</b>	<b>County</b>	<b>County-Wide</b>	<b>8,324</b>	<b>\$14,898.00</b>	<b>52.2</b>
Shannon	City	Birch Tree	634	\$0.00	
Shannon	City	Eminence	548	\$0.00	
Shannon	City	Summersville	544	\$0.00	
Shannon	City	Winona	1,290	\$0.00	

County	Community	Community Name	Population	Average Income	Per Capita Income
	Type		2000	Per Capita	% of US 1999
<b>Shelby</b>	<b>County</b>	<b>County-Wide</b>	<b>6,799</b>	<b>\$19,397.00</b>	<b>67.9</b>
Shelby	Village	Bethel	121	\$0.00	
Shelby	City	Clarence	915	\$0.00	
Shelby	City	Hunnewell	227	\$0.00	
Shelby	Village	Leonard	66	\$0.00	
Shelby	City	Shelbina	1,943	\$0.00	
Shelby	City	Shelbyville	682	\$0.00	
<b>St. Charles</b>	<b>County</b>	<b>County-Wide</b>	<b>283,883</b>	<b>\$27,586.00</b>	<b>96.6</b>
St. Charles	Village	Augusta	218	\$0.00	
St. Charles	City	Cottleville	1,928	\$0.00	
St. Charles	Village	Dardenne Prairie	4,384	\$0.00	
St. Charles	City	Flint Hill	379	\$0.00	
St. Charles	City	Foristell	331	\$0.00	
St. Charles	Village	Josephville	270	\$0.00	
St. Charles	City	Lake St. Louis	10,169	\$0.00	
St. Charles	Village	New Melle	124	\$0.00	
St. Charles	City	O'Fallon	46,169	\$0.00	
St. Charles	City	Portage Des Sioux	351	\$0.00	
St. Charles	City	St. Charles	60,321	\$0.00	
St. Charles	City	St. Paul	1,634	\$0.00	
St. Charles	City	St. Peters	51,381	\$0.00	
St. Charles	City	Weldon Spring	5,270	\$0.00	
St. Charles	Village	Weldon Spring Heights	79	\$0.00	
St. Charles	City	Wentzville	6,896	\$0.00	
St. Charles		West Alton	573	\$0.00	
<b>St. Clair</b>	<b>County</b>	<b>County-Wide</b>	<b>9,652</b>	<b>\$16,615.00</b>	<b>58.2</b>
St. Clair	City	Appleton City	1,314	\$0.00	
St. Clair	Village	Collins	176	\$0.00	
St. Clair	Village	Gerster	35	\$0.00	
St. Clair	City	Lowry City	728	\$0.00	
St. Clair	City	Osceola	835	\$0.00	
St. Clair	Village	Roscoe	112	\$0.00	
St. Clair	Village	Vista	55	\$0.00	
<b>St. Francois</b>	<b>County</b>	<b>County-Wide</b>	<b>55,641</b>	<b>\$18,215.00</b>	<b>63.8</b>
St. Francois	City	Bismarck	1,470	\$0.00	
St. Francois	City	Bonne Terre	4,039	\$0.00	
St. Francois	City	Desloge	4,802	\$0.00	
St. Francois	City	Farmington	13,924	\$0.00	
St. Francois	City	Iron Mountain Lake	693	\$0.00	
St. Francois	City	Leadington	206	\$0.00	
St. Francois	City	Leadwood	1,160	\$0.00	
St. Francois	City	Park Hills	7,861	\$0.00	
<b>St. Louis</b>	<b>County</b>	<b>County-Wide</b>	<b>1,016,315</b>	<b>\$38,886.00</b>	<b>136.2</b>
St. Louis	City	Ballwin	31,283	\$0.00	

County	Community	Community Name	Population	Average Income	Per Capita Income
	Type		2000	Per Capita	% of US 1999
St. Louis	City	Bella Villa	687	\$0.00	
St. Louis	City	Bellefontaine Neighbors	11,271	\$0.00	
St. Louis	Village	Bellerive	254	\$0.00	
St. Louis	Village	Bel-Nor	1,598	\$0.00	
St. Louis	Village	Bel-Ridge	3,082	\$0.00	
St. Louis	City	Berkeley	10,063	\$0.00	
St. Louis	City	Beverly Hills	603	\$0.00	
St. Louis	City	Black Jack	6,792	\$0.00	
St. Louis	City	Breckenridge Hills	4,817	\$0.00	
St. Louis	City	Brentwood	7,693	\$0.00	
St. Louis	City	Bridgeton	15,550	\$0.00	
St. Louis	Village	Calverton Park	1,322	\$0.00	
St. Louis	Village	Champ	12	\$0.00	
St. Louis	City	Charlack	1,431	\$0.00	
St. Louis	City	Chesterfield	46,802	\$0.00	
St. Louis	City	Clarkson Valley	2,675	\$0.00	
St. Louis	City	Clayton	12,825	\$0.00	
St. Louis	City	Cool Valley	1,081	\$0.00	
St. Louis	City	Country Club Hills	1,381	\$0.00	
St. Louis	Village	Country Life Acres	81	\$0.00	
St. Louis	City	Crestwood	11,863	\$0.00	
St. Louis	City	Creve Coeur	16,500	\$0.00	
St. Louis	City	Crystal Lake Park	457	\$0.00	
St. Louis	City	Dellwood	5,255	\$0.00	
St. Louis	City	Des Peres	8,592	\$0.00	
St. Louis	City	Edmundson	840	\$0.00	
St. Louis	City	Ellisville	9,104	\$0.00	
St. Louis	City	Eureka	7,676	\$0.00	
St. Louis	City	Fenton	4,360	\$0.00	
St. Louis	City	Ferguson	22,406	\$0.00	
St. Louis	City	Flordell Hills	931	\$0.00	
St. Louis	City	Florissant	50,497	\$0.00	
St. Louis	City	Frontenac	3,483	\$0.00	
St. Louis	City	Glendale	5,767	\$0.00	
St. Louis	Village	Glen Echo Park	166	\$0.00	
St. Louis	Village	Grantwood Village	883	\$0.00	
St. Louis	City	Greendale	722	\$0.00	
St. Louis	City	Green Park	2,666	\$0.00	
St. Louis	Village	Hanley Hills	2,124	\$0.00	
St. Louis	City	Hazelwood	26,206	\$0.00	
St. Louis	Village	Hillsdale	1,477	\$0.00	
St. Louis	City	Huntleigh	323	\$0.00	
St. Louis	City	Jennings	15,469	\$0.00	
St. Louis	City	Kinloch	449	\$0.00	

County	Community	Community Name	Population	Average Income	Per Capita Income
	Type		2000	Per Capita	% of US 1999
St. Louis	City	Kirkwood	27,324	\$0.00	
St. Louis	City	Ladue	8,645	\$0.00	
St. Louis	City	Lakeshire	1,375	\$0.00	
St. Louis	Village	Mackenzie	137	\$0.00	
St. Louis	City	Manchester	19,161	\$0.00	
St. Louis	City	Maplewood	9,228	\$0.00	
St. Louis	Village	Marlborough	2,235	\$0.00	
St. Louis	City	Maryland Heights	25,756	\$0.00	
St. Louis	City	Moline Acres	2,662	\$0.00	
St. Louis	City	Normandy	5,153	\$0.00	
St. Louis	City	Northwoods	4,643	\$0.00	
St. Louis	Village	Norwood Court	1,061	\$0.00	
St. Louis	City	Oakland	1,540	\$0.00	
St. Louis	City	Olivette	7,438	\$0.00	
St. Louis	City	Overland	16,838	\$0.00	
St. Louis	City	Pacific	5,482	\$0.00	
St. Louis	City	Pagedale	3,616	\$0.00	
St. Louis	City	Pasadena Hills	1,147	\$0.00	
St. Louis	Village	Pasadena Park	489	\$0.00	
St. Louis	City	Pine Lawn	4,204	\$0.00	
St. Louis	City	Richmond Heights	9,602	\$0.00	
St. Louis	Village	Riverview	3,146	\$0.00	
St. Louis	City	Rock Hill	4,765	\$0.00	
St. Louis	City	St. Ann	13,607	\$0.00	
St. Louis	City	St. George	1,288	\$0.00	
St. Louis	City	St. John	6,871	\$0.00	
<b>St. Louis</b>	<b>City</b>	<b>St. Louis</b>	<b>348,189</b>	<b>\$26,963.00</b>	
St. Louis	City	Shrewsbury	6,644	\$0.00	
St. Louis	City	Sunset Hills	8,267	\$0.00	
St. Louis	Village	Sycamore Hills	722	\$0.00	
St. Louis	City	Town and Country	10,894	\$0.00	
St. Louis	Village	Twin Oaks	362	\$0.00	
St. Louis	City	University City	37,428	\$0.00	
St. Louis	Village	Uplands Park	460	\$0.00	
St. Louis	City	Valley Park	6,518	\$0.00	
St. Louis	City	Velda City	1,616	\$0.00	
St. Louis	Village	Velda Village Hills	1,090	\$0.00	
St. Louis	City	Vinita Park	1,924	\$0.00	
St. Louis	Village	Vinita Terrace	292	\$0.00	
St. Louis	City	Warson Woods	1,983	\$0.00	
St. Louis	City	Webster Groves	23,230	\$0.00	
St. Louis	City	Wellston	2,460	\$0.00	
St. Louis	Village	Westwood	284	\$0.00	
St. Louis	Village	Wilbur Park	475	\$0.00	

County	Community	Community Name	Population	Average Income	Per Capita Income
	Type		2000	Per Capita	% of US 1999
St. Louis	City	Wildwood	32,884	\$0.00	
St. Louis	City	Winchester	1,651	\$0.00	
St. Louis	City	Woodson Terrace	4,189	\$0.00	
<b>Ste. Genevieve</b>	<b>County</b>	<b>County-Wide</b>	<b>17,842</b>	<b>\$21,152.00</b>	<b>74.1</b>
Ste. Genevieve	City	Bloomsdale	419	\$0.00	
Ste. Genevieve	City	Ste. Genevieve	4,476	\$0.00	
Ste. Genevieve	City	St. Mary	377	\$0.00	
<b>Stoddard</b>	<b>County</b>	<b>County-Wide</b>	<b>29,705</b>	<b>\$19,552.00</b>	<b>68.5</b>
Stoddard	City	Advance	1,244	\$0.00	
Stoddard		Baker	5	\$0.00	
Stoddard	City	Bell City	461	\$0.00	
Stoddard	City	Bernie	1,777	\$0.00	
Stoddard	City	Bloomfield	1,952	\$0.00	
Stoddard	City	Dexter	7,356	\$0.00	
Stoddard	City	Dudley	289	\$0.00	
Stoddard	City	Essex	524	\$0.00	
Stoddard	City	Puxico	1,145	\$0.00	
<b>Stone</b>	<b>County</b>	<b>County-Wide</b>	<b>28,658</b>	<b>\$21,660.00</b>	<b>75.9</b>
Stone	Village	Blue Eye	129	\$0.00	
Stone	City	Branson West	408	\$0.00	
Stone	Village	Coney Island	94	\$0.00	
Stone	City	Crane	1,390	\$0.00	
Stone	City	Galena	451	\$0.00	
Stone	City	Hurley	157	\$0.00	
Stone	Village	Indian Point	588	\$0.00	
Stone	City	Kimberling City	2,253	\$0.00	
Stone	Village	McCord Bend	292	\$0.00	
Stone	City	Reeds Spring	465	\$0.00	
<b>Sullivan</b>	<b>County</b>	<b>County-Wide</b>	<b>7,219</b>	<b>\$19,856.00</b>	<b>69.6</b>
Sullivan	City	Greencastle	308	\$0.00	
Sullivan	City	Green City	688	\$0.00	
Sullivan	City	Harris	105	\$0.00	
Sullivan	Village	Humphreys	164	\$0.00	
Sullivan	City	Milan	1,958	\$0.00	
Sullivan	City	Newtown	209	\$0.00	
Sullivan	Village	Osgood	51	\$0.00	
Sullivan		Pollock	131	\$0.00	
<b>Taney</b>	<b>County</b>	<b>County-Wide</b>	<b>39,703</b>	<b>\$22,035.00</b>	<b>77.2</b>
Taney	City	Branson	6,050	\$0.00	
Taney	Village	Bull Creek	225	\$0.00	
Taney	City	Forsyth	1,686	\$0.00	
Taney	City	Hollister	3,867	\$0.00	
Taney	Village	Merriam Woods	1,142	\$0.00	
Taney	City	Rockaway Beach	577	\$0.00	

County	Community	Community Name	Population	Average Income	Per Capita Income
	Type		2000	Per Capita	% of US 1999
Taney	Village	Table Rock	229	\$0.00	
Taney	Village	Taneyville	359	\$0.00	
<b>Texas</b>	<b>County</b>	<b>County-Wide</b>	<b>23,003</b>	<b>\$15,166.00</b>	<b>53.1</b>
Texas	City	Cabool	2,168	\$0.00	
Texas	City	Houston	1,992	\$0.00	
Texas	City	Licking	1,471	\$0.00	
Texas	Village	Raymondville	442	\$0.00	
Texas	City	Mountain Grove	4,574	\$0.00	
Texas	City	Summersville	544	\$0.00	
<b>Vernon</b>	<b>County</b>	<b>County-Wide</b>	<b>20,454</b>	<b>\$19,420.00</b>	<b>68</b>
Vernon	City	Bronaugh	245	\$0.00	
Vernon	Village	Deerfield	75	\$0.00	
Vernon	Village	Harwood	90	\$0.00	
Vernon	Village	Metz	67	\$0.00	
Vernon	Village	Milo	84	\$0.00	
Vernon	Village	Moundville	103	\$0.00	
Vernon	City	Nevada	8,607	\$0.00	
Vernon	Village	Richards	95	\$0.00	
Vernon	City	Schell City	286	\$0.00	
Vernon	City	Sheldon	529	\$0.00	
Vernon	Village	Stotesbury	43	\$0.00	
Vernon	City	Walker	275	\$0.00	
<b>Warren</b>	<b>County</b>	<b>County-Wide</b>	<b>24,525</b>	<b>\$21,060.00</b>	<b>73.8</b>
Warren	Village	Innsbrook	469	\$0.00	
Warren	City	Marthasville	837	\$0.00	
Warren	City	Truesdale	397	\$0.00	
Warren	City	Warrenton	5,281	\$0.00	
Warren	City	Wright City	1,532	\$0.00	
Warren	City	Foristell	331	\$0.00	
<b>Washington</b>	<b>County</b>	<b>County-Wide</b>	<b>23,344</b>	<b>\$15,883.00</b>	<b>55.6</b>
Washington	Village	Caledonia	158	\$0.00	
Washington	City	Irondale	437	\$0.00	
Washington	Village	Mineral Point	363	\$0.00	
Washington	City	Potosi	2,662	\$0.00	
<b>Wayne</b>	<b>County</b>	<b>County-Wide</b>	<b>13,259</b>	<b>\$15,137.00</b>	<b>53</b>
Wayne	City	Greenville	451	\$0.00	
Wayne	Village	Mill Spring	219	\$0.00	
Wayne	City	Piedmont	1,992	\$0.00	
Wayne	City	Williamsville	379	\$0.00	
<b>Webster</b>	<b>County</b>	<b>County-Wide</b>	<b>31,045</b>	<b>\$16,822.00</b>	<b>58.9</b>
Webster	Village	Diggins	298	\$0.00	
Webster	City	Fordland	684	\$0.00	
Webster	City	Marshfield	5,720	\$0.00	
Webster	City	Niangua	445	\$0.00	



County	Community	Community Name	Population	Average Income	Per Capita Income
	Type		2000	Per Capita	% of US 1999
Webster	City	Rogersville	1,508	\$0.00	
Webster	City	Seymour	1,834	\$0.00	
<b>Worth</b>	<b>County</b>	<b>County-Wide</b>	<b>2,382</b>	<b>\$16,911.00</b>	<b>59.2</b>
Worth	City	Allendale	54	\$0.00	
Worth	Village	Denver	40	\$0.00	
Worth	City	Grant City	926	\$0.00	
Worth	City	Sheridan	185	\$0.00	
Worth	Village	Worth	94	\$0.00	
<b>Wright</b>	<b>County</b>	<b>County-Wide</b>	<b>17,955</b>	<b>\$14,410.00</b>	<b>50.5</b>
Wright	City	Hartville	607	\$0.00	
Wright	City	Mansfield	1,349	\$0.00	
Wright	City	Mountain Grove	4,574	\$0.00	
Wright	City	Norwood	552	\$0.00	

## **Appendix 2 - Listing of county and community social and economic trends within the State of Missouri.**

For more information about social and economic trends concerning labor/jobs and income, populations, public services and retail trade, visit Iowa State's SETA Office of Social and Economic Trends at <http://www.seta.iastate.edu/city/citybycounty.aspx?state=MO> or press control + left mouse click on the links below if viewing this plan in electronic format.

### **Adair County:**

[Brashear](#), [Gibbs](#), [Greentop](#), [Kirksville](#), [Millard](#), [Novinger](#)

### **Andrew County:**

[Amazonia](#), [Bolckow](#), [Cosby](#), [Country Club](#), [Fillmore](#), [Rea](#), [Rosendale](#), [Savannah](#)

### **Atchison County:**

[Fairfax](#), [Rock Port](#), [Tarkio](#), [Watson](#), [Westboro](#)

### **Audrain County:**

[Benton City](#), [Centralia](#), [Farber](#), [Laddonia](#), [Martinsburg](#), [Mexico](#), [Rush Hill](#), [Vandalia](#), [Vandiver](#)

### **Barry County:**

[Arrow Point](#), [Butterfield](#), [Cassville](#), [Chain-O-Lakes](#), [Emerald Beach](#), [Exeter](#), [Monett](#), [Purdy](#), [Seligman](#), [Shell Knob](#), [Washburn](#), [Wheaton](#)

### **Barton County:**

[Burgess](#), [Golden City](#), [Lamar](#), [Lamar Heights](#), [Liberal](#), [Milford](#), [Mindenmines](#)

### **Bates County:**

[Adrian](#), [Amoret](#), [Amsterdam](#), [Butler](#), [Drexel](#), [Foster](#), [Hume](#), [Merwin](#), [Passaic](#), [Rich Hill](#), [Rockville](#)

### **Benton County:**

[Cole Camp](#), [Ionia](#), [Lincoln](#), [Warsaw](#)

### **Bollinger County:**

[Glen Allen](#), [Marble Hill](#), [Sedgewickville](#), [Zalma](#)

### **Boone County:**

[Ashland](#), [Centralia](#), [Columbia](#), [Hallsville](#), [Harrisburg](#), [Hartsburg](#), [McBaine](#), [Rocheport](#), [Sturgeon](#)

### **Buchanan County:**

[Agency](#), [Dearborn](#), [De Kalb](#), [Easton](#), [Gower](#), [Lewis and Clark Village](#), [Rushville](#), [St. Joseph](#)

### **Butler County:**

[Fisk](#), [Neelyville](#), [Poplar Bluff](#), [Qulin](#)

**Caldwell County:**

[Braymer](#), [Breckenridge](#), [Cowgill](#), [Hamilton](#), [Kidder](#), [Kingston](#), [Polo](#)

**Callaway County:**

[Auxvasse](#), [Fulton](#), [Holts Summit](#), [Jefferson City](#), [Kingdom City](#), [Lake Mykee Town](#), [Mokane](#), [New Bloomfield](#)

**Camden County:**

[Camdenton](#), [Climax Springs](#), [Lake Ozark](#), [Linn Creek](#), [Macks Creek](#), [Osage Beach](#), [Richland](#), [Stoutland](#), [Sunrise Beach](#), [Village of Four Seasons](#)

**Cape Girardeau County:**

[Allenville](#), [Cape Girardeau](#), [Delta](#), [Dutchtown](#), [Gordonville](#), [Jackson](#), [Oak Ridge](#), [Old Appleton](#), [Pocahontas](#), [Scott City](#), [Whitewater](#)

**Carroll County:**

[Bogard](#), [Bosworth](#), [Carrollton](#), [De Witt](#), [Hale](#), [Norborne](#), [Tina](#)

**Carter County:**

[Ellsinore](#), [Grandin](#), [Van Buren](#)

**Cass County:**

[Archie](#), [Baldwin Park](#), [Belton](#), [Cleveland](#), [Creighton](#), [Drexel](#), [East Lynne](#), [Freeman](#), [Garden City](#), [Gunn City](#), [Harrisonville](#), [Kansas City](#), [Lake Annette](#), [Lake Winnebago](#), [Lee's Summit](#), [Peculiar](#), [Pleasant Hill](#), [Raymore](#), [Strasburg](#), [West Line](#)

**Cedar County:**

[El Dorado Springs](#), [Jerico Springs](#), [Stockton](#), [Umber View Heights](#)

**Chariton County:**

[Brunswick](#), [Dalton](#), [Glasgow](#), [Keytesville](#), [Marceline](#), [Mendon](#), [Rothville](#), [Salisbury](#), [Sumner](#), [Triplett](#)

**Christian County:**

[Billings](#), [Clever](#), [Fremont Hills](#), [Highlandville](#), [Nixa](#), [Ozark](#), [Sparta](#), [Spokane](#), [Springfield](#)

**Clark County:**

[Alexandria](#), [Kahoka](#), [Luray](#), [Revere](#), [Wayland](#), [Wyaconda](#)

**Clay County:**

[Avondale](#), [Birmingham](#), [Claycomo](#), [Excelsior Estates](#), [Excelsior Springs](#), [Gladstone](#), [Glenaire](#), [Holt](#), [Independence](#), [Kansas City](#), [Kearney](#), [Lawson](#), [Liberty](#), [Missouri City](#), [Mosby](#), [North Kansas City](#), [Oaks](#), [Oakview](#), [Oakwood](#), [Oakwood Park](#), [Pleasant Valley](#), [Prathersville](#), [Randolph](#), [Smithville](#), [Sugar Creek](#)

**Clinton County:**

[Cameron](#), [Gower](#), [Holt](#), [Lathrop](#), [Osborn](#), [Plattsburg](#), [Trimble](#), [Turney](#)

**Cole County:**

[Centertown](#), [Jefferson City](#), [Lohman](#), [Russellville](#), [St. Martins](#), [St. Thomas](#), [Taos](#), [Wardsville](#)

**Cooper County:**

[Blackwater](#), [Boonville](#), [Bunceton](#), [Otterville](#), [Pilot Grove](#), [Prairie Home](#), [Wooldridge](#)

**Crawford County:**

[Bourbon](#), [Cuba](#), [Leasburg](#), [St. Cloud](#), [Steelville](#), [Sullivan](#)

**Dade County:**

[Arcola](#), [Dadeville](#), [Everton](#), [Greenfield](#), [Lockwood](#), [South Greenfield](#)

**Dallas County:**

[Buffalo](#), [Louisburg](#), [Urbana](#)

**Daviess County:**

[Altamont](#), [Coffey](#), [Gallatin](#), [Gilman City](#), [Jameson](#), [Jamesport](#), [Lock Springs](#), [Pattonsburg](#), [Winston](#)

**De Kalb County:**

[Amity](#), [Cameron](#), [Clarksdale](#), [Maysville](#), [Osborn](#), [Stewartsville](#), [Union Star](#), [Weatherby](#)

**Dent County:**

[Bunker](#), [Salem](#)

**Douglas County:**

[Ava](#)

**Dunklin County:**

[Arbyrd](#), [Campbell](#), [Cardwell](#), [Clarkton](#), [Holcomb](#), [Hornersville](#), [Kennett](#), [Malden](#), [Rives](#), [Senath](#)

**Franklin County:**

[Berger](#), [Gerald](#), [Gray Summit](#), [Leslie](#), [Miramiguo Park](#), [New Haven](#), [Oak Grove](#), [Pacific](#), [Parkway](#), [St. Clair](#), [Sullivan](#), [Union](#), [Villa Ridge](#), [Washington](#)

**Gasconade County:**

[Bland](#), [Gasconade](#), [Hermann](#), [Morrison](#), [Owensville](#), [Rosebud](#)

**Gentry County:**

[Albany](#), [Darlington](#), [Gentry](#), [King City](#), [McFall](#), [Stanberry](#)

**Greene County:**

[Ash Grove](#), [Battlefield](#), [Brookline](#), [Fair Grove](#), [Republic](#), [Rogersville](#), [Springfield](#), [Strafford](#), [Walnut Grove](#), [Willard](#)

**Grundv County:**

[Brimson](#), [Galt](#), [Laredo](#), [Spickard](#), [Tindall](#), [Trenton](#)

**Harrison County:**

[Bethany](#), [Blythedale](#), [Cainsville](#), [Eagleville](#), [Gilman City](#), [Mount Moriah](#), [New Hampton](#), [Ridgeway](#)

**Henry County:**

[Blairstown](#), [Brownington](#), [Calhoun](#), [Clinton](#), [Deepwater](#), [Hartwell](#), [La Due](#), [Montrose](#), [Tightwad](#), [Urich](#), [Windsor](#)

**Hickory County:**

[Cross Timbers](#), [Hermitage](#), [Preston](#), [Weaubleau](#), [Wheatland](#)

**Holt County:**

[Bigelow](#), [Big Lake](#), [Corning](#), [Craig](#), [Forest City](#), [Fortescue](#), [Maitland](#), [Mound City](#), [Oregon](#)

**Howard County:**

[Armstrong](#), [Fayette](#), [Franklin](#), [Glasgow](#), [New Franklin](#)

**Howell County:**

[Brandsville](#), [Mountain View](#), [West Plains](#), [Willow Springs](#)

**Iron County:**

[Annapolis](#), [Arcadia](#), [Des Arc](#), [Ironton](#), [Pilot Knob](#), [Viburnum](#)

**Jackson County:**

[Blue Springs](#), [Buckner](#), [Grain Valley](#), [Grandview](#), [Greenwood](#), [Independence](#), [Kansas City](#), [Lake Lotawana](#), [Lake Tapawingo](#), [Lee's Summit](#), [Levasy](#), [Lone Jack](#), [Oak Grove](#), [Raytown](#), [River Bend](#), [Sibley](#), [Sugar Creek](#), [Unity Village](#)

**Jasper County:**

[Airport Drive](#), [Alba](#), [Asbury](#), [Avilla](#), [Brooklyn Heights](#), [Carl Junction](#), [Carterville](#), [Carthage](#), [Carytown](#), [Duenweg](#), [Duquesne](#), [Fidelity](#), [Jasper](#), [Joplin](#), [La Russell](#), [Neck City](#), [Oronogo](#), [Purcell](#), [Reeds](#), [Sarcozie](#), [Waco](#), [Webb City](#)

**Jefferson County:**

[Arnold](#), [Barnhart](#), [Byrnes Mill](#), [Cedar Hill](#), [Cedar Hill Lakes](#), [Crystal City](#), [De Soto](#), [Festus](#), [Herculaneum](#), [High Ridge](#), [Hillsboro](#), [Horine](#), [Imperial](#), [Kimmswick](#), [Murphy](#), [Olympian Village](#), [Parkdale](#), [Pevely](#), [Scotsdale](#)

**Johnson County:**

[Centerview](#), [Chilhowee](#), [Holden](#), [Kingsville](#), [Knob Noster](#), [Lathrop](#), [La Tour](#), [Leeton](#), [Warrensburg](#), [Whiteman AFB](#)

**Knox County:**

[Baring](#), [Edina](#), [Hurdland](#), [Knox City](#), [Newark](#), [Novelty](#)

**Laclede County:**

[Conway](#), [Lebanon](#), [Phillipsburg](#), [Richland](#), [Stoutland](#), [Twin Bridges](#)

**Lafayette County:**

[Alma](#), [Aullville](#), [Bates City](#), [Blackburn](#), [Concordia](#), [Corder](#), [Dover](#), [Emma](#), [Higginsville](#), [Lake Lafayette](#), [Lexington](#), [Mayview](#), [Napoleon](#), [Oak Grove](#), [Odessa](#), [Waverly](#), [Wellington](#)

**Lawrence County:**

[Aurora](#), [Freistatt](#), [Halltown](#), [Hoberg](#), [Marionville](#), [Miller](#), [Monett](#), [Mount Vernon](#), [Pierce City](#), [Stotts City](#), [Verona](#)

**Lewis County:**

[Canton](#), [Ewing](#), [La Belle](#), [La Grange](#), [Lewistown](#), [Monticello](#)

**Lincoln County:**

[Cave](#), [Chain of Rocks](#), [Elsberry](#), [Foley](#), [Fountain N' Lakes](#), [Hawk Point](#), [Moscow Mills](#), [Old Monroe](#), [Silex](#), [Troy](#), [Truxton](#), [Whiteside](#), [Winfield](#)

**Linn County:**

[Brookfield](#), [Browning](#), [Bucklin](#), [Laclede](#), [Linneus](#), [Marceline](#), [Meadville](#), [Purdin](#)

**Livingston County:**

[Chillicothe](#), [Chula](#), [Ludlow](#), [Mooresville](#), [Utica](#), [Wheeling](#)

**McDonald County:**

[Anderson](#), [Goodman](#), [Lanagan](#), [Noel](#), [Pineville](#), [South West City](#)

**Macon County:**

[Atlanta](#), [Bevier](#), [Callao](#), [Elmer](#), [Ethel](#), [La Plata](#), [Macon](#), [New Cambria](#), [South Gifford](#)

**Madison County:**

[Cobalt](#), [Fredericktown](#), [Junction City](#), [Marquand](#)

**Maries County:**

[Argyle](#), [Belle](#), [Vienna](#)

**Marion County:**

[Hannibal](#), [Monroe City](#), [Palmyra](#)

**Mercer County:**

[Mercer](#), [Princeton](#), [South Lineville](#)

**Miller County:**

[Bagnell](#), [Brumley](#), [Eldon](#), [Iberia](#), [Lake Ozark](#), [Lakeside](#), [Olean](#), [Osage Beach](#), [St. Elizabeth](#),

[Tuscumbia](#)

**[Mississippi County:](#)**

[Anniston](#), [Bertrand](#), [Charleston](#), [East Prairie](#), [Pinhook](#), [Wilson City](#), [Wyatt](#)

**[Moniteau County:](#)**

[California](#), [Clarksburg](#), [Jamestown](#), [Lupus](#), [Tipton](#)

**[Monroe County:](#)**

[Florida](#), [Holliday](#), [Madison](#), [Monroe City](#), [Paris](#), [Stoutsville](#)

**[Montgomery County:](#)**

[Bellflower](#), [High Hill](#), [Jonesburg](#), [McKittrick](#), [Middletown](#), [Montgomery City](#), [New Florence](#), [Rhineland](#), [Wellsville](#)

**[Morgan County:](#)**

[Barnett](#), [Gravois Mills](#), [Laurie](#), [Stover](#), [Sunrise Beach](#), [Syracuse](#), [Versailles](#)

**[New Madrid County:](#)**

[Canalou](#), [Catron](#), [Gideon](#), [Howardville](#), [Lilbourn](#), [Marston](#), [Matthews](#), [Morehouse](#), [New Madrid](#), [North Lilbourn](#), [Parma](#), [Portageville](#), [Risco](#), [Sikeston](#), [Tallapoosa](#)

**[Newton County:](#)**

[Cliff Village](#), [Dennis Acres](#), [Diamond](#), [Fairview](#), [Granby](#), [Grand Falls Plaza](#), [Joplin](#), [Leawood](#), [Loma Linda](#), [Neosho](#), [Newtonia](#), [Redings Mill](#), [Ritchey](#), [Saginaw](#), [Seneca](#), [Shoal Creek Drive](#), [Shoal Creek Estates](#), [Silver Creek](#), [Stark City](#), [Stella](#), [Wentworth](#)

**[Nodaway County:](#)**

[Arkoe](#), [Barnard](#), [Burlington Junction](#), [Clearmont](#), [Clyde](#), [Conception Junction](#), [Elmo](#), [Graham](#), [Guilford](#), [Hopkins](#), [Maryville](#), [Parnell](#), [Pickering](#), [Quitman](#), [Ravenwood](#), [Skidmore](#)

**[Oregon County:](#)**

[Alton](#), [Koshkonong](#), [Thayer](#)

**[Osage County:](#)**

[Argyle](#), [Belle](#), [Bland](#), [Chamois](#), [Freeburg](#), [Linn](#), [Meta](#), [Westphalia](#)

**[Ozark County:](#)**

[Bakersfield](#), [Gainesville](#), [Sundown](#), [Theodosia](#)

**[Pemiscot County:](#)**

[Bragg City](#), [Caruthersville](#), [Cooter](#), [Hayti](#), [Hayti Heights](#), [Hayward](#), [Holland](#), [Homestown](#), [North Wardell](#), [Pascola](#), [Portageville](#), [Steele](#), [Wardell](#)

**[Perry County:](#)**

[Altenburg](#), [Biehle](#), [Frohna](#), [Lithium](#), [Longtown](#), [Perryville](#)

**Pettis County:**

[Green Ridge](#), [Houstonia](#), [Hughesville](#), [Ionia](#), [La Monte](#), [Sedalia](#), [Smithton](#), [Windsor](#)

**Phelps County:**

[Doolittle](#), [Edgar Springs](#), [Newburg](#), [Rolla](#), [St. James](#)

**Pike County:**

[Annada](#), [Ashburn](#), [Bowling Green](#), [Clarksville](#), [Curryville](#), [Eolia](#), [Frankford](#), [Louisiana](#), [Paynesville](#), [Tarrants](#)

**Platte County:**

[Camden Point](#), [Dearborn](#), [Edgerton](#), [Farley](#), [Ferrelview](#), [Houston Lake](#), [Iatan](#), [Kansas City](#), [Lake Waukomis](#), [Northmoor](#), [Parkville](#), [Platte City](#), [Platte Woods](#), [Ridgely](#), [Riverside](#), [Tracy](#), [Weatherby Lake](#), [Weston](#)

**Polk County:**

[Aldrich](#), [Bolivar](#), [Fair Play](#), [Flemington](#), [Halfway](#), [Humansville](#), [Morrisville](#), [Pleasant Hope](#)

**Pulaski County:**

[Crocker](#), [Dixon](#), [Fort Leonard Wood](#), [Richland](#), [St. Robert](#), [Waynesville](#)

**Putnam County:**

[Livonia](#), [Lucerne](#), [Powersville](#), [Unionville](#), [Worthington](#)

**Ralls County:**

[Center](#), [Hannibal](#), [Monroe City](#), [New London](#), [Perry](#), [Rensselaer](#), [Vandalia](#)

**Randolph County:**

[Cairo](#), [Clark](#), [Clifton Hill](#), [Higbee](#), [Huntsville](#), [Jacksonville](#), [Moberly](#), [Renick](#)

**Ray County:**

[Camden](#), [Crystal Lakes](#), [Elmira](#), [Excelsior Estates](#), [Excelsior Springs](#), [Fleming](#), [Hardin](#), [Henrietta](#), [Homestead](#), [Lawson](#), [Orrick](#), [Rayville](#), [Richmond](#), [Woods Heights](#)

**Reynolds County:**

[Bunker](#), [Centerville](#), [Ellington](#)

**Ripley County:**

[Doniphan](#), [Naylor](#)

**St. Charles County:**

[Augusta](#), [Cottleville](#), [Dardenne Prairie](#), [Flint Hill](#), [Foristell](#), [Josephville](#), [Lake St. Louis](#), [New Melle](#), [O'Fallon](#), [Portage Des Sioux](#), [St. Charles](#), [St. Paul](#), [St. Peters](#), [Weldon Spring](#), [Weldon Spring Heights](#), [Wentzville](#), [West Alton](#)



**St. Clair County:**

Appleton City, Collins, Gerster, Lowry City, Osceola, Roscoe, Vista

**Ste. Genevieve County:**

Bloomsdale, Ste. Genevieve, St. Mary

**St. Francois County:**

Bismarck, Bonne Terre, Desloge, Farmington, Iron Mountain Lake, Leadington, Leadwood, Park Hills

**St. Louis County:**

Aftton, Ballwin, Bella Villa, Bellefontaine Neighbors, Bellerive, Bel-Nor, Bel-Ridge, Berkeley, Beverly Hills, Black Jack, Breckenridge Hills, Brentwood, Bridgeton, Calverton Park, Castle Point, Champ, Charlack, Chesterfield, Clarkson Valley, Clayton, Concord, Cool Valley, Country Club Hills, Country Life Acres, Crestwood, Creve Coeur, Crystal Lake Park, Dellwood, Des Peres, Edmundson, Ellisville, Eureka, Fenton, Ferguson, Flordell Hills, Florissant, Frontenac, Glasgow Village, Glendale, Glen Echo Park, Grantwood Village, Greendale, Green Park, Hanley Hills, Hazelwood, Hillsdale, Huntleigh, Jennings, Kinloch, Kirkwood, Ladue, Lakeshire, Lemay, Mackenzie, Manchester, Maplewood, Marlborough, Maryland Heights, Mehlville, Moline Acres, Normandy, Northwoods, Norwood Court, Oakland, Oakville, Olivette, Overland, Pacific, Pagedale, Pasadena Hills, Pasadena Park, Pine Lawn, Richmond Heights, Riverview, Rock Hill, St. Ann, St. George, St. John, Sappington, Shrewsbury, Spanish Lake, Sunset Hills, Sycamore Hills, Town and Country, Twin Oaks, University City, Uplands Park, Valley Park, Velda City, Velda Village Hills, Vinita Park, Vinita Terrace, Warson Woods, Webster Groves, Wellston, Westwood, Wilbur Park, Wildwood, Winchester, Woodson Terrace

**Saline County:**

Arrow Rock, Blackburn, Emma, Gilliam, Grand Pass, Malta Bend, Marshall, Miami, Mount Leonard, Nelson, Slater, Sweet Springs

**Schuyler County:**

Downing, Glenwood, Greentop, Lancaster, Queen City

**Scotland County:**

Arbela, Granger, Memphis, Rutledge, South Gorin

**Scott County:**

Benton, Blodgett, Cape Girardeau, Chaffee, Commerce, Diehlstadt, Haywood City, Kelso, Lambert, Miner, Morley, Oran, Scott City, Sikeston, Vanduser

**Shannon County:**

Birch Tree, Eminence, Summersville, Winona

**Shelby County:**

Bethel, Clarence, Hunnewell, Leonard, Shelbina, Shelbyville

**Stoddard County:**

[Advance](#), [Baker](#), [Bell City](#), [Bernie](#), [Bloomfield](#), [Dexter](#), [Dudley](#), [Essex](#), [Penermon](#), [Puxico](#)

**Stone County:**

[Blue Eye](#), [Branson West](#), [Coney Island](#), [Crane](#), [Galena](#), [Hurley](#), [Indian Point](#), [Kimberling City](#), [McCord Bend](#), [Reeds Spring](#), [Shell Knob](#)

**Sullivan County:**

[Browning](#), [Greencastle](#), [Green City](#), [Harris](#), [Humphreys](#), [Milan](#), [Newtown](#), [Osgood](#), [Pollock](#)

**Taney County:**

[Branson](#), [Bull Creek](#), [Forsyth](#), [Hollister](#), [Merriam Woods](#), [Rockaway Beach](#), [Table Rock](#), [Taneyville](#)

**Texas County:**

[Cabool](#), [Houston](#), [Licking](#), [Mountain Grove](#), [Raymondville](#), [Summersville](#)

**Vernon County:**

[Bronaugh](#), [Deerfield](#), [Harwood](#), [Metz](#), [Milo](#), [Moundville](#), [Nevada](#), [Richards](#), [Schell City](#), [Sheldon](#), [Stotesbury](#), [Walker](#)

**Warren County:**

[Foristell](#), [Innsbrook](#), [Marthasville](#), [Truesdale](#), [Warrenton](#), [Wright City](#)

**Washington County:**

[Caledonia](#), [Irondale](#), [Mineral Point](#), [Potosi](#)

**Wayne County:**

[Greenville](#), [Mill Spring](#), [Piedmont](#), [Williamsville](#)

**Webster County:**

[Diggins](#), [Fordland](#), [Marshfield](#), [Niangua](#), [Rogersville](#), [Seymour](#)

**Worth County:**

[Allendale](#), [Denver](#), [Grant City](#), [Irena](#), [Sheridan](#), [Worth](#)

**Wright County:**

[Hartville](#), [Mansfield](#), [Mountain Grove](#), [Norwood](#)

**St. Louis (Independent City) County:**

[St. Louis](#)

### Appendix 3 - Listing of all communities within the State of Missouri with a population of 3,000 or less.

This listing shows the 1990 and 2000 census populations, including the percent change, for every municipality (114) in the State of Missouri with a population of 3,000 or less.

County	Community	Community Name	Population	Average Income	Per Capita Income
	Type		2000	Per Capita	% of US 1999
<b>Adair</b>	<b>County</b>	<b>County-Wide</b>	<b>24,977</b>	<b>\$19,542.00</b>	<b>68.5</b>
Adair	City	Brashear	280	\$0.00	
Adair	Village	Gibbs	100	\$0.00	
Adair	City	Greentop	427	\$0.00	
Adair	Village	Millard	75	\$0.00	
Adair	City	Novinger	534	\$0.00	
<b>Andrew</b>	<b>County</b>	<b>County-Wide</b>	<b>16,492</b>	<b>\$22,718.00</b>	<b>79.6</b>
Andrew	City	Amazonia	277	\$0.00	
Andrew	City	Bolckow	234	\$0.00	
Andrew	Village	Cosby	143	\$0.00	
Andrew	Village	Country Club	1,846	\$0.00	
Andrew	City	Fillmore	211	\$0.00	
Andrew	Village	Rea	56	\$0.00	
Andrew	City	Rosendale	180	\$0.00	
<b>Atchison</b>	<b>County</b>	<b>County-Wide</b>	<b>6,430</b>	<b>\$20,895.00</b>	<b>73.2</b>
Atchison	City	Fairfax	645	\$0.00	
Atchison	City	Rock Port	1,395	\$0.00	
Atchison	City	Tarkio	1,935	\$0.00	
Atchison	Village	Watson	121	\$0.00	
Atchison	City	Westboro	163	\$0.00	
<b>Audrain</b>	<b>County</b>	<b>County-Wide</b>	<b>25,853</b>	<b>\$23,175.00</b>	<b>81.2</b>
Audrain	Village	Benton City	122	\$0.00	
Audrain	City	Farber	411	\$0.00	
Audrain	City	Ladsonia	620	\$0.00	
Audrain	City	Martinsburg	326	\$0.00	
Audrain	Village	Rush Hill	130	\$0.00	
Audrain	City	Vandalia	2,529	\$0.00	
Audrain	Village	Vandiver	83	\$0.00	
<b>Barry</b>	<b>County</b>	<b>County-Wide</b>	<b>34,010</b>	<b>\$18,739.00</b>	<b>65.6</b>
Barry	Village	Arrow Point	133	\$0.00	
Barry	Village	Butterfield	397	\$0.00	
Barry	City	Cassville	2,890	\$0.00	
Barry	Village	Chain-O-Lakes	127	\$0.00	
Barry	Village	Emerald Beach	250	\$0.00	
Barry	City	Exeter	707	\$0.00	
Barry	City	Purdy	1,103	\$0.00	
Barry	City	Seligman	877	\$0.00	
Barry	City	Washburn	448	\$0.00	

County	Community	Community Name	Population	Average Income	Per Capita Income
	Type		2000	Per Capita	% of US 1999
Barry	City	Wheaton	721	\$0.00	
<b>Barton</b>	<b>County</b>	<b>County-Wide</b>	<b>12,541</b>	<b>\$19,759.00</b>	<b>69.2</b>
Barton	Village	Burgess	70	\$0.00	
Barton	City	Golden City	884	\$0.00	
Barton	Village	Lamar Heights	216	\$0.00	
Barton	City	Liberal	779	\$0.00	
Barton	Village	Milford	52	\$0.00	
Barton	City	Mindenmines	409	\$0.00	
<b>Bates</b>	<b>County</b>	<b>County-Wide</b>	<b>16,653</b>	<b>\$18,888.00</b>	<b>66.2</b>
Bates	City	Adrian	1,780	\$0.00	
Bates	City	Amoret	211	\$0.00	
Bates	City	Amsterdam	281	\$0.00	
Bates	City	Drexel	1,090	\$0.00	
Bates	Village	Foster	130	\$0.00	
Bates	City	Hume	337	\$0.00	
Bates	Village	Merwin	83	\$0.00	
Bates	Village	Passaic	40	\$0.00	
Bates	City	Rich Hill	1,461	\$0.00	
Bates	City	Rockville	162	\$0.00	
<b>Benton</b>	<b>County</b>	<b>County-Wide</b>	<b>17,180</b>	<b>\$16,338.00</b>	<b>57.2</b>
Benton	City	Cole Camp	1,028	\$0.00	
Benton	Village	Ionia	108	\$0.00	
Benton	City	Lincoln	1,026	\$0.00	
Benton	City	Warsaw	2,070	\$0.00	
<b>Bollinger</b>	<b>County</b>	<b>County-Wide</b>	<b>12,029</b>	<b>\$15,311.00</b>	<b>53.6</b>
Bollinger	Village	Glen Allen	145	\$0.00	
Bollinger	City	Marble Hill	1,502	\$0.00	
Bollinger	Village	Sedgewickville	197	\$0.00	
Bollinger	Village	Zalma	93	\$0.00	
<b>Boone</b>	<b>County</b>	<b>County-Wide</b>	<b>135,454</b>	<b>\$26,568.00</b>	<b>93.1</b>
Boone	City	Ashland	1,869	\$0.00	
Boone	City	Hallsville	978	\$0.00	
Boone	Village	Harrisburg	184	\$0.00	
Boone	Village	Hartsburg	108	\$0.00	
Boone	Village	McBaine	17	\$0.00	
Boone	City	Rocheport	208	\$0.00	
Boone	City	Sturgeon	944	\$0.00	
<b>Buchanan</b>	<b>County</b>	<b>County-Wide</b>	<b>85,998</b>	<b>\$23,964.00</b>	<b>83.9</b>
Buchanan	Village	Agency	599	\$0.00	
Buchanan	City	De Kalb	257	\$0.00	
Buchanan	City	Easton	258	\$0.00	
Buchanan	City	Gower	1,399	\$0.00	
Buchanan	Village	Lewis and Clark Village	155	\$0.00	
Buchanan	Village	Rushville	280	\$0.00	

County	Community	Community Name	Population	Average Income	Per Capita Income
	Type		2000	Per Capita	% of US 1999
<b>Butler</b>	<b>County</b>	<b>County-Wide</b>	<b>40,867</b>	<b>\$21,590.00</b>	<b>75.6</b>
Butler	City	Fisk	363	\$0.00	
Butler	City	Neelyville	487	\$0.00	
Butler	City	Qulin	467	\$0.00	
<b>Caldwell</b>	<b>County</b>	<b>County-Wide</b>	<b>8,969</b>	<b>\$17,394.00</b>	<b>60.9</b>
Caldwell	City	Braymer	910	\$0.00	
Caldwell	City	Breckenridge	454	\$0.00	
Caldwell	City	Cowgill	247	\$0.00	
Caldwell	City	Hamilton	1,813	\$0.00	
Caldwell	City	Kidder	271	\$0.00	
Caldwell	City	Kingston	287	\$0.00	
Caldwell	City	Polo	582	\$0.00	
<b>Callaway</b>	<b>County</b>	<b>County-Wide</b>	<b>40,766</b>	<b>\$21,199.00</b>	<b>74.3</b>
Callaway	City	Auxvasse	901	\$0.00	
Callaway	City	Holts Summit	2,935	\$0.00	
Callaway	Village	Kingdom City	121	\$0.00	
Callaway	City	Lake Mykee Town	326	\$0.00	
Callaway	City	Mokane	188	\$0.00	
Callaway	City	New Bloomfield	599	\$0.00	
<b>Camden</b>	<b>County</b>	<b>County-Wide</b>	<b>37,051</b>	<b>\$22,667.00</b>	<b>79.4</b>
Camden	City	Camdenton	2,779	\$0.00	
Camden	Village	Climax Springs	80	\$0.00	
Camden	City	Lake Ozark	1,489	\$0.00	
Camden	City	Linn Creek	280	\$0.00	
Camden	City	Macks Creek	267	\$0.00	
Camden	City	Richland	1,805	\$0.00	
Camden	City	Stoutland	177	\$0.00	
Camden	Village	Sunrise Beach	368	\$0.00	
Camden	Village	Village of Four Seasons	1,493	\$0.00	
<b>Cape Girardeau</b>	<b>County</b>	<b>County-Wide</b>	<b>68,693</b>	<b>\$24,886.00</b>	<b>87.2</b>
Cape	Village	Allenville	104	\$0.00	
Cape	City	Delta	517	\$0.00	
Cape	Village	Dutchtown	99	\$0.00	
Cape	Village	Gordonville	425	\$0.00	
Cape	Village	Oak Ridge	202	\$0.00	
Cape	Village	Old Appleton	82	\$0.00	
Cape	Village	Pocahontas	127	\$0.00	
Cape	Village	Whitewater	113	\$0.00	
<b>Carroll</b>	<b>County</b>	<b>County-Wide</b>	<b>10,285</b>	<b>\$20,440.00</b>	<b>71.6</b>
Carroll	City	Bogard	234	\$0.00	
Carroll	City	Bosworth	382	\$0.00	
Carroll	City	De Witt	120	\$0.00	
Carroll	City	Hale	473	\$0.00	
Carroll	City	Norborne	805	\$0.00	

County	Community	Community Name	Population	Average Income	Per Capita Income
	Type		2000	Per Capita	% of US 1999
Carroll	Village	Tina	193	\$0.00	
<b>Carter</b>	<b>County</b>	<b>County-Wide</b>	<b>5,941</b>	<b>\$15,652.00</b>	<b>54.8</b>
Carter	City	Ellsinore	363	\$0.00	
Carter	City	Grandin	236	\$0.00	
Carter	City	Van Buren	845	\$0.00	
<b>Cass</b>	<b>County</b>	<b>County-Wide</b>	<b>82,092</b>	<b>\$23,351.00</b>	<b>81.8</b>
Cass	City	Archie	890	\$0.00	
Cass	Village	Baldwin Park	115	\$0.00	
Cass	City	Cleveland	592	\$0.00	
Cass	City	Creighton	322	\$0.00	
Cass	City	East Lynne	300	\$0.00	
Cass	City	Freeman	521	\$0.00	
Cass	City	Garden City	1,500	\$0.00	
Cass	Village	Gunn City	85	\$0.00	
Cass	City	Lake Annette	163	\$0.00	
Cass	City	Lake Winnebago	902	\$0.00	
Cass	City	Peculiar	2,604	\$0.00	
Cass	City	Strasburg	136	\$0.00	
Cass	Village	West Line	95	\$0.00	
<b>Cedar</b>	<b>County</b>	<b>County-Wide</b>	<b>13,733</b>	<b>\$16,712.00</b>	<b>58.5</b>
Cedar	Village	Jerico Springs	259	\$0.00	
Cedar	City	Stockton	1,960	\$0.00	
Cedar	Village	Umber View Heights	52	\$0.00	
<b>Chariton</b>	<b>County</b>	<b>County-Wide</b>	<b>8,438</b>	<b>\$19,297.00</b>	<b>67.6</b>
Chariton	City	Brunswick	925	\$0.00	
Chariton	Village	Dalton	27	\$0.00	
Chariton	City	Keytesville	533	\$0.00	
Chariton	City	Marceline	2,558	\$0.00	
Chariton	City	Mendon	208	\$0.00	
Chariton	Village	Rothville	93	\$0.00	
Chariton	City	Salisbury	1,726	\$0.00	
Chariton	City	Sumner	142	\$0.00	
Chariton	City	Triplett	64	\$0.00	
<b>Christian</b>	<b>County</b>	<b>County-Wide</b>	<b>54,285</b>	<b>\$20,309.00</b>	<b>71.1</b>
Christian	City	Billings	1,091	\$0.00	
Christian	City	Clever	1,010	\$0.00	
Christian	City	Fremont Hills	597	\$0.00	
Christian	City	Highlandville	872	\$0.00	
Christian	City	Sparta	1,144	\$0.00	
<b>Clark</b>	<b>County</b>	<b>County-Wide</b>	<b>7,416</b>	<b>\$16,306.00</b>	<b>57.1</b>
Clark	City	Alexandria	166	\$0.00	
Clark	City	Kahoka	2,241	\$0.00	
Clark	Village	Luray	102	\$0.00	
Clark	Village	Revere	121	\$0.00	

County	Community	Community Name	Population	Average Income	Per Capita Income
	Type		2000	Per Capita	% of US 1999
Clark	City	Wayland	425	\$0.00	
Clark	City	Wyaconda	310	\$0.00	
<b>Clay</b>	<b>County</b>	<b>County-Wide</b>	<b>184,006</b>	<b>\$28,503.00</b>	<b>99.8</b>
Clay	City	Avondale	529	\$0.00	
Clay	Village	Birmingham	214	\$0.00	
Clay	Village	Claycomo	1,267	\$0.00	
Clay	City	Excelsior Estates	263	\$0.00	
Clay	City	Glenaire	553	\$0.00	
Clay	City	Holt	405	\$0.00	
Clay	City	Lawson	2,336	\$0.00	
Clay	City	Missouri City	295	\$0.00	
Clay	City	Mosby	242	\$0.00	
Clay	Village	Oaks	136	\$0.00	
Clay	Village	Oakview	386	\$0.00	
Clay	Village	Oakwood	197	\$0.00	
Clay	Village	Oakwood Park	183	\$0.00	
Clay	Village	Prathersville	111	\$0.00	
Clay	City	Randolph	47	\$0.00	
<b>Clinton</b>	<b>County</b>	<b>County-Wide</b>	<b>18,979</b>	<b>\$23,210.00</b>	<b>81.3</b>
Clinton	City	Lathrop	2,092	\$0.00	
Clinton	City	Plattsburg	2,354	\$0.00	
Clinton	City	Trimble	451	\$0.00	
Clinton	Village	Turney	155	\$0.00	
Clinton	City	Gower	1,399	\$0.00	
Clinton	City	Osborn	455	\$0.00	
<b>Cole</b>	<b>County</b>	<b>County-Wide</b>	<b>71,397</b>	<b>\$27,884.00</b>	<b>97.7</b>
Cole	Village	Centertown	257	\$0.00	
Cole	City	Lohman	168	\$0.00	
Cole	City	Russellville	758	\$0.00	
Cole	City	St. Martins	1,023	\$0.00	
Cole	City	St. Thomas	287	\$0.00	
Cole	City	Taos	870	\$0.00	
Cole	Village	Wardsville	976	\$0.00	
<b>Cooper</b>	<b>County</b>		<b>16,670</b>	<b>\$20,150.00</b>	<b>70.6</b>
Cooper	City	Blackwater	199	\$0.00	
Cooper	City	Bunceton	348	\$0.00	
Cooper	City	Oterville	476	\$0.00	
Cooper	City	Pilot Grove	723	\$0.00	
Cooper	City	Prairie Home	220	\$0.00	
Cooper	Village	Wooldridge	47	\$0.00	
<b>Crawford</b>	<b>County</b>	<b>County-Wide</b>	<b>22,804</b>	<b>\$18,373.00</b>	<b>64.4</b>
Crawford	City	Bourbon	1,348	\$0.00	
Crawford	Village	Leasburg	323	\$0.00	
Crawford		St. Cloud	56	\$0.00	

County	Community	Community Name	Population	Average Income	Per Capita Income
	Type		2000	Per Capita	% of US 1999
Crawford	City	Steelville	1,429	\$0.00	
<b>Dade</b>	<b>County</b>	<b>County-Wide</b>	<b>7,923</b>	<b>\$18,703.00</b>	<b>65.5</b>
Dade	Village	Arcola	45	\$0.00	
Dade	Village	Dadeville	224	\$0.00	
Dade	City	Everton	322	\$0.00	
Dade	City	Greenfield	1,358	\$0.00	
Dade	City	Lockwood	989	\$0.00	
Dade	Village	South Greenfield	136	\$0.00	
<b>Dallas</b>	<b>County</b>	<b>County-Wide</b>	<b>15,661</b>	<b>\$17,388.00</b>	<b>60.9</b>
Dallas	City	Buffalo	2,781	\$0.00	
Dallas	Village	Louisburg	147	\$0.00	
Dallas	City	Urbana	407	\$0.00	
<b>Daviess</b>	<b>County</b>	<b>County-Wide</b>	<b>8,016</b>	<b>\$18,323.00</b>	<b>64.2</b>
Daviess	Village	Altamont	218	\$0.00	
Daviess	City	Coffey	140	\$0.00	
Daviess	City	Gallatin	1,789	\$0.00	
Daviess	Village	Jameson	120	\$0.00	
Daviess	City	Jamesport	505	\$0.00	
Daviess	Village	Lock Springs	69	\$0.00	
Daviess	City	Pattonsburg	261	\$0.00	
Daviess	Village	Winston	247	\$0.00	
<b>DeKalb</b>	<b>County</b>	<b>County-Wide</b>	<b>11,597</b>	<b>\$14,969.00</b>	<b>52.4</b>
DeKalb	Village	Amity	70	\$0.00	
DeKalb	City	Clarksdale	351	\$0.00	
DeKalb	City	Maysville	1,212	\$0.00	
DeKalb	City	Osborn	455	\$0.00	
DeKalb	City	Stewartsville	759	\$0.00	
DeKalb	City	Union Star	433	\$0.00	
DeKalb	Village	Weatherby	123	\$0.00	
<b>Dent</b>	<b>County</b>	<b>County-Wide</b>	<b>14,927</b>	<b>\$18,900.00</b>	<b>66.2</b>
Dent	City	Bunker	427	\$0.00	
<b>Douglas</b>	<b>County</b>	<b>County-Wide</b>	<b>13,084</b>	<b>\$15,393.00</b>	<b>53.9</b>
<b>Dunklin</b>	<b>County</b>	<b>County-Wide</b>	<b>33,155</b>	<b>\$19,007.00</b>	<b>66.6</b>
Dunklin	City	Arbyrd	528	\$0.00	
Dunklin	City	Campbell	1,883	\$0.00	
Dunklin	City	Cardwell	789	\$0.00	
Dunklin	City	Clarkton	1,330	\$0.00	
Dunklin	City	Holcomb	696	\$0.00	
Dunklin	City	Hornersville	686	\$0.00	
Dunklin		Rives	88	\$0.00	
Dunklin	City	Senath	1,650	\$0.00	
<b>Franklin</b>	<b>County</b>	<b>County-Wide</b>	<b>93,807</b>	<b>\$24,007.00</b>	<b>84.1</b>
Franklin	City	Berger	206	\$0.00	
Franklin	City	Gerald	1,171	\$0.00	



County	Community	Community Name	Population	Average Income	Per Capita Income
	Type		2000	Per Capita	% of US 1999
Franklin	Village	Leslie	87	\$0.00	
Franklin	Village	Miramiguoa Park	127	\$0.00	
Franklin	City	New Haven	1,867	\$0.00	
Franklin	Village	Oak Grove (Franklin)	382	\$0.00	
Franklin	Village	Parkway	280	\$0.00	
<b>Gasconade</b>	<b>County</b>	<b>County-Wide</b>	<b>15,342</b>	<b>\$21,357.00</b>	<b>74.8</b>
Gasconade	City	Bland	565	\$0.00	
Gasconade	City	Gasconade	267	\$0.00	
Gasconade	City	Hermann	2,674	\$0.00	
Gasconade	City	Morrison	123	\$0.00	
Gasconade	City	Owensville	2,500	\$0.00	
Gasconade	City	Rosebud	364	\$0.00	
<b>Gentry</b>	<b>County</b>	<b>County-Wide</b>	<b>6,861</b>	<b>\$19,983.00</b>	<b>66.5</b>
Gentry	City	Albany	1,937	\$0.00	
Gentry	City	Darlington	113	\$0.00	
Gentry	Village	Gentry	101	\$0.00	
Gentry	City	King City	1,012	\$0.00	
Gentry	Village	McFall	135	\$0.00	
Gentry	City	Stanberry	1,243	\$0.00	
<b>Greene</b>	<b>County</b>	<b>County-Wide</b>	<b>240,391</b>	<b>\$26,496.00</b>	<b>92.8</b>
Greene	City	Ash Grove	1,430	\$0.00	
Greene	City	Battlefield	2,385	\$0.00	
Greene	Village	Brookline	326	\$0.00	
Greene	City	Fair Grove	1,107	\$0.00	
Greene	City	Strafford	1,845	\$0.00	
Greene	City	Walnut Grove	630	\$0.00	
Greene	City	Rogersville	1,508	\$0.00	
<b>Grundy</b>	<b>County</b>	<b>County-Wide</b>	<b>10,432</b>	<b>\$20,802.00</b>	<b>72.9</b>
Grundy	Village	Brimson	63	\$0.00	
Grundy	City	Galt	275	\$0.00	
Grundy	City	Laredo	250	\$0.00	
Grundy	City	Spickard	315	\$0.00	
Grundy	City	Tindall	65	\$0.00	
<b>Harrison</b>	<b>County</b>	<b>County-Wide</b>	<b>8,850</b>	<b>\$19,502.00</b>	<b>68.3</b>
Harrison	Village	Blythedale	233	\$0.00	
Harrison	City	Cainsville	370	\$0.00	
Harrison	Village	Eagleville	321	\$0.00	
Harrison	City	Gilman City	380	\$0.00	
Harrison	Village	Mount Moriah	143	\$0.00	
Harrison	City	New Hampton	349	\$0.00	
Harrison	City	Ridgeway	530	\$0.00	
<b>Henry</b>	<b>County</b>	<b>County-Wide</b>	<b>21,997</b>	<b>\$20,120.00</b>	<b>70.5</b>
Henry	City	Blairstown	141	\$0.00	
Henry	City	Brownington	119	\$0.00	

County	Community	Community Name	Population	Average Income	Per Capita Income
	Type		2000	Per Capita	% of US 1999
Henry	City	Calhoun	491	\$0.00	
Henry	City	Deepwater	507	\$0.00	
Henry		Hartwell	16	\$0.00	
Henry		La Due	39	\$0.00	
Henry	City	Montrose	417	\$0.00	
Henry	Village	Tightwad	63	\$0.00	
Henry	City	Urich	499	\$0.00	
<b>Hickory</b>	<b>County</b>	<b>County-Wide</b>	<b>8,940</b>	<b>\$14,951.00</b>	<b>52.4</b>
Hickory	City	Cross Timbers	185	\$0.00	
Hickory	City	Hermitage	406	\$0.00	
Hickory	Village	Preston	113	\$0.00	
Hickory	City	Weaubleau	518	\$0.00	
Hickory	City	Wheatland	388	\$0.00	
<b>Holt</b>	<b>County</b>	<b>County-Wide</b>	<b>5,351</b>	<b>\$20,370.00</b>	<b>71.4</b>
Holt	Village	Bigelow	38	\$0.00	
Holt	Village	Big Lake	127	\$0.00	
Holt	Village	Corning	21	\$0.00	
Holt	City	Craig	309	\$0.00	
Holt	City	Forest City	338	\$0.00	
Holt	Village	Fortescue	51	\$0.00	
Holt	City	Maitland	342	\$0.00	
Holt	City	Mound City	1,193	\$0.00	
Holt	City	Oregon	935	\$0.00	
<b>Howard</b>	<b>County</b>	<b>County-Wide</b>	<b>10,212</b>	<b>\$20,114.00</b>	<b>70.5</b>
Howard	City	Armstrong	287	\$0.00	
Howard	City	Fayette	2,793	\$0.00	
Howard	City	Franklin	112	\$0.00	
Howard	City	Glasgow	1,263	\$0.00	
Howard	City	New Franklin	1,145	\$0.00	
<b>Howell</b>	<b>County</b>	<b>County-Wide</b>	<b>37,238</b>	<b>\$18,420.00</b>	<b>64.5</b>
Howell	City	Brandsville	174	\$0.00	
Howell	City	Mountain View	2,430	\$0.00	
Howell	City	Willow Springs	2,147	\$0.00	
<b>Iron</b>	<b>County</b>	<b>County-Wide</b>	<b>10,697</b>	<b>\$16,619.00</b>	<b>58.2</b>
Iron	City	Annapolis	310	\$0.00	
Iron	City	Arcadia	567	\$0.00	
Iron	City	Des Arc	187	\$0.00	
Iron	City	Ironton	1,471	\$0.00	
Iron	City	Pilot Knob	697	\$0.00	
Iron	City	Viburnum	825	\$0.00	
<b>Jackson</b>	<b>County</b>	<b>County-Wide</b>	<b>654,880</b>	<b>\$28,258.00</b>	<b>99</b>
Jackson	City	Buckner	2,725	\$0.00	
Jackson	City	Lake Lotawana	1,872	\$0.00	
Jackson	City	Lake Tapawingo	843	\$0.00	

County	Community	Community Name	Population	Average Income	Per Capita Income
	Type		2000	Per Capita	% of US 1999
Jackson	City	Levasy	108	\$0.00	
Jackson	City	Lone Jack	528	\$0.00	
Jackson	Village	River Bend	10	\$0.00	
Jackson	Village	Sibley	347	\$0.00	
Jackson	Village	Unity Village	140	\$0.00	
<b>Jasper</b>	<b>County</b>	<b>County-Wide</b>	<b>104,686</b>	<b>\$22,865.00</b>	<b>80.1</b>
Jasper	Village	Airport Drive	622	\$0.00	
Jasper	City	Alba	588	\$0.00	
Jasper	City	Asbury	218	\$0.00	
Jasper	Village	Avilla	137	\$0.00	
Jasper	Village	Brooklyn Heights	125	\$0.00	
Jasper	City	Cartersville	1,850	\$0.00	
Jasper	Village	Carytown	217	\$0.00	
Jasper	City	Duenweg	1,034	\$0.00	
Jasper	Village	Duquesne	1,640	\$0.00	
Jasper	Village	Fidelity	252	\$0.00	
Jasper	City	Jasper	1,011	\$0.00	
Jasper	Village	La Russell	138	\$0.00	
Jasper	City	Neck City	119	\$0.00	
Jasper	City	Oronogo	976	\$0.00	
Jasper	City	Purcell	357	\$0.00	
Jasper	Village	Reeds	103	\$0.00	
Jasper	City	Sarcoxi	1,354	\$0.00	
Jasper	City	Waco	86	\$0.00	
<b>Jefferson</b>	<b>County</b>	<b>County-Wide</b>	<b>198,099</b>	<b>\$21,600.00</b>	<b>75.7</b>
Jefferson	City	Byrnes Mill	2,376	\$0.00	
Jefferson	Village	Cedar Hill Lakes	229	\$0.00	
Jefferson	City	Herculaneum	2,805	\$0.00	
Jefferson	City	Hillsboro	1,675	\$0.00	
Jefferson	City	Kimmswick	94	\$0.00	
Jefferson	City	Olympian Village	669	\$0.00	
Jefferson	Village	Parkdale	205	\$0.00	
Jefferson	Village	Scotsdale	211	\$0.00	
<b>Johnson</b>	<b>County</b>	<b>County-Wide</b>	<b>48,258</b>	<b>\$19,365.00</b>	<b>67.8</b>
Johnson	City	Centerview	249	\$0.00	
Johnson	City	Chilhowee	329	\$0.00	
Johnson	City	Holden	2,510	\$0.00	
Johnson	City	Kingsville	257	\$0.00	
Johnson	City	Knob Noster	2,462	\$0.00	
Johnson	Village	La Tour	65	\$0.00	
Johnson	City	Leeton	619	\$0.00	
<b>Knox</b>	<b>County</b>	<b>County-Wide</b>	<b>4,361</b>	<b>\$17,133.00</b>	<b>60</b>
Knox	City	Baring	159	\$0.00	
Knox	City	Edina	1,233	\$0.00	

County	Community	Community Name	Population	Average Income	Per Capita Income
	Type		2000	Per Capita	% of US 1999
Knox	City	Hurdland	239	\$0.00	
Knox	City	Knox City	223	\$0.00	
Knox	Village	Newark	100	\$0.00	
Knox	City	Novelty	119	\$0.00	
<b>Laclede</b>	<b>County</b>	<b>County-Wide</b>	<b>32,513</b>	<b>\$19,473.00</b>	<b>68.2</b>
Laclede	City	Conway	743	\$0.00	
Laclede	Village	Phillipsburg	201	\$0.00	
Laclede	Village	Twin Bridges	42	\$0.00	
Laclede	City	Richland	1,805	\$0.00	
Laclede	City	Stoutland	177	\$0.00	
<b>Lafayette</b>	<b>County</b>	<b>County-Wide</b>	<b>32,960</b>	<b>\$22,445.00</b>	<b>78.6</b>
Lafayette	City	Alma	399	\$0.00	
Lafayette	Village	Aullville	86	\$0.00	
Lafayette	City	Bates City	245	\$0.00	
Lafayette	City	Blackburn	284	\$0.00	
Lafayette	City	Concordia	2,360	\$0.00	
Lafayette	City	Corder	427	\$0.00	
Lafayette	Village	Dover	108	\$0.00	
Lafayette	City	Emma	243	\$0.00	
Lafayette	City	Lake Lafayette	346	\$0.00	
Lafayette	City	Mayview	294	\$0.00	
Lafayette	City	Napoleon	208	\$0.00	
Lafayette	City	Waverly	806	\$0.00	
Lafayette	City	Wellington	784	\$0.00	
<b>Lawrence</b>	<b>County</b>	<b>County-Wide</b>	<b>35,204</b>	<b>\$17,882.00</b>	<b>62.6</b>
Lawrence	Village	Freistatt	184	\$0.00	
Lawrence	Village	Halltown	189	\$0.00	
Lawrence	Village	Hoberg	60	\$0.00	
Lawrence	City	Marionville	2,113	\$0.00	
Lawrence	City	Miller	754	\$0.00	
Lawrence	City	Pierce City	1,385	\$0.00	
Lawrence	City	Stotts City	250	\$0.00	
Lawrence	City	Verona	714	\$0.00	
<b>Lewis</b>	<b>County</b>	<b>County-Wide</b>	<b>10,494</b>	<b>\$16,965.00</b>	<b>59.4</b>
Lewis	City	Canton	2,557	\$0.00	
Lewis	City	Ewing	464	\$0.00	
Lewis	City	La Belle	669	\$0.00	
Lewis	City	La Grange	1,000	\$0.00	
Lewis	City	Lewistown	595	\$0.00	
Lewis	Village	Monticello	126	\$0.00	
<b>Lincoln</b>	<b>County</b>	<b>County-Wide</b>	<b>38,944</b>	<b>\$21,685.00</b>	<b>76</b>
Lincoln		Cave	7	\$0.00	
Lincoln	Village	Chain of Rocks	91	\$0.00	
Lincoln	City	Elsberry	2,047	\$0.00	

County	Community	Community Name	Population	Average Income	Per Capita Income
	Type		2000	Per Capita	% of US 1999
Lincoln	City	Foley	178	\$0.00	
Lincoln	Village	Fountain N' Lakes	129	\$0.00	
Lincoln	City	Hawk Point	459	\$0.00	
Lincoln	City	Moscow Mills	1,742	\$0.00	
Lincoln	City	Old Monroe	250	\$0.00	
Lincoln	Village	Silex	206	\$0.00	
Lincoln	Village	Truxton	96	\$0.00	
Lincoln	Village	Whiteside	67	\$0.00	
Lincoln	City	Winfield	723	\$0.00	
<b>Linn</b>	<b>County</b>	<b>County-Wide</b>	<b>13,754</b>	<b>\$20,038.00</b>	<b>70.2</b>
Linn	City	Browning	317	\$0.00	
Linn	City	Bucklin	524	\$0.00	
Linn	City	Laclede	415	\$0.00	
Linn	City	Linneus	369	\$0.00	
Linn	City	Meadville	457	\$0.00	
Linn	City	Purdin	223	\$0.00	
Linn	City	Marceline	2,558	\$0.00	
<b>Livingston</b>	<b>County</b>		<b>14,558</b>	<b>\$24,013.00</b>	<b>84.1</b>
Livingston	City	Chula	198	\$0.00	
Livingston	Village	Ludlow	204	\$0.00	
Livingston	Village	Mooreville	89	\$0.00	
Livingston	Village	Utica	274	\$0.00	
Livingston	City	Wheeling	268	\$0.00	
<b>Macon</b>	<b>County</b>	<b>County-Wide</b>	<b>15,762</b>	<b>\$19,163.00</b>	<b>67.1</b>
Macon	City	Atlanta	450	\$0.00	
Macon	City	Bevier	723	\$0.00	
Macon	City	Callao	291	\$0.00	
Macon	City	Elmer	98	\$0.00	
Macon	City	Ethel	100	\$0.00	
Macon	City	La Plata	1,486	\$0.00	
Macon	City	New Cambria	222	\$0.00	
Macon	Village	South Gifford	72	\$0.00	
<b>Madison</b>	<b>County</b>	<b>County-Wide</b>	<b>11,800</b>	<b>\$17,498.00</b>	<b>61.3</b>
Madison	Village	Cobalt	189	\$0.00	
Madison	Village	Junction City	319	\$0.00	
Madison	City	Marquand	251	\$0.00	
<b>Maries</b>	<b>County</b>	<b>County-Wide</b>	<b>8,903</b>	<b>\$17,648.00</b>	<b>61.8</b>
Maries	Village	Argyle	164	\$0.00	
Maries	City	Belle	1,344	\$0.00	
Maries	City	Vienna	628	\$0.00	
<b>Marion</b>	<b>County</b>	<b>County-Wide</b>	<b>28,289</b>	<b>\$22,188.00</b>	<b>77.7</b>
Marion/Monroe	City	Monroe City	2,588	\$0.00	
<b>McDonald</b>	<b>County</b>	<b>County-Wide</b>	<b>21,681</b>	<b>\$16,850.00</b>	<b>59</b>
McDonald	City	Anderson	1,856	\$0.00	

County	Community	Community Name	Population	Average Income	Per Capita Income
	Type		2000	Per Capita	% of US 1999
McDonald	City	Goodman	1,183	\$0.00	
McDonald	City	Lanagan	411	\$0.00	
McDonald	City	Noel	1,480	\$0.00	
McDonald	City	Pineville	768	\$0.00	
McDonald	City	South West City	855	\$0.00	
<b>Mercer</b>	<b>County</b>	<b>County-Wide</b>	<b>3,757</b>	<b>\$15,737.00</b>	<b>55.1</b>
Mercer	City	Mercer	342	\$0.00	
Mercer	City	Princeton	1,047	\$0.00	
Mercer	Village	South Lineville	37	\$0.00	
<b>Miller</b>	<b>County</b>	<b>County-Wide</b>	<b>23,564</b>	<b>\$17,833.00</b>	<b>62.5</b>
Miller	City	Bagnell	86	\$0.00	
Miller	Village	Brumley	102	\$0.00	
Miller	City	Iberia	605	\$0.00	
Miller	City	Lakeside	37	\$0.00	
Miller	Village	Olean	157	\$0.00	
Miller	Village	St. Elizabeth	297	\$0.00	
Miller	Village	Tuscumbia	218	\$0.00	
Miller	City	Lake Ozark	1,489	\$0.00	
<b>Mississippi</b>	<b>County</b>	<b>County-Wide</b>	<b>13,427</b>	<b>\$18,681.00</b>	<b>65.4</b>
Mississippi	City	Anniston	285	\$0.00	
Mississippi	City	Bertrand	740	\$0.00	
Mississippi	Village	Pinhook	48	\$0.00	
Mississippi	Village	Wilson City	165	\$0.00	
Mississippi	City	Wyatt	364	\$0.00	
Mississippi/Scott	City	Miner	1,056	\$0.00	
<b>Moniteau</b>	<b>County</b>	<b>County-Wide</b>	<b>14,827</b>	<b>\$20,452.00</b>	<b>71.6</b>
Moniteau	City	Clarksburg	375	\$0.00	
Moniteau	City	Jamestown	382	\$0.00	
Moniteau	City	Lupus	29	\$0.00	
<b>Monroe</b>	<b>County</b>	<b>County-Wide</b>	<b>9,311</b>	<b>\$18,945.00</b>	<b>66.4</b>
Monroe		Florida	9	\$0.00	
Monroe	Village	Holliday	129	\$0.00	
Monroe	City	Madison	586	\$0.00	
Monroe	City	Paris	1,529	\$0.00	
Monroe	Village	Stoutsville	44	\$0.00	
Monroe	City	Monroe City	2,588	\$0.00	
<b>Montgomery</b>	<b>County</b>	<b>County-Wide</b>	<b>12,136</b>	<b>\$20,094.00</b>	<b>70.4</b>
Montgomery	City	Bellflower	427	\$0.00	
Montgomery	City	High Hill	231	\$0.00	
Montgomery	City	Jonesburg	695	\$0.00	
Montgomery	City	McKittrick	72	\$0.00	
Montgomery	City	Middletown	199	\$0.00	
Montgomery	City	Montgomery City	2,442	\$0.00	
Montgomery	City	New Florence	764	\$0.00	

County	Community	Community Name	Population	Average Income	Per Capita Income
	Type		2000	Per Capita	% of US 1999
Montgomery	Village	Rhineland	176	\$0.00	
Montgomery	City	Wellsville	1,423	\$0.00	
<b>Morgan</b>	<b>County</b>	<b>County-Wide</b>	<b>19,309</b>	<b>\$18,091.00</b>	<b>63.4</b>
Morgan	City	Barnett	207	\$0.00	
Morgan	Village	Gravois Mills	208	\$0.00	
Morgan	Village	Laurie	663	\$0.00	
Morgan	City	Stover	968	\$0.00	
Morgan	City	Syracuse	172	\$0.00	
Morgan	City	Versailles	2,565	\$0.00	
Morgan	Village	Sunrise Beach	368	\$0.00	
<b>New Madrid</b>	<b>County</b>	<b>County-Wide</b>	<b>19,760</b>	<b>\$17,862.00</b>	<b>62.6</b>
New Madrid	City	Canalou	348	\$0.00	
New Madrid	City	Catron	68	\$0.00	
New Madrid	City	Gideon	1,113	\$0.00	
New Madrid	City	Howardville	342	\$0.00	
New Madrid	City	Lilbourn	1,303	\$0.00	
New Madrid	City	Marston	610	\$0.00	
New Madrid	City	Matthews	605	\$0.00	
New Madrid	City	Morehouse	1,015	\$0.00	
New Madrid	Village	North Lilbourn	95	\$0.00	
New Madrid	City	Parma	852	\$0.00	
New Madrid	City	Risco	392	\$0.00	
New Madrid	Village	Tallapoosa	204	\$0.00	
<b>Newton</b>	<b>County</b>	<b>County-Wide</b>	<b>52,636</b>	<b>\$21,587.00</b>	<b>75.6</b>
Newton	Village	Cliff Village	33	\$0.00	
Newton	Village	Dennis Acres	68	\$0.00	
Newton	City	Diamond	807	\$0.00	
Newton	City	Fairview	395	\$0.00	
Newton	City	Granby	2,121	\$0.00	
Newton	Village	Grand Falls Plaza	104	\$0.00	
Newton	Village	Leawood	904	\$0.00	
Newton	Village	Loma Linda	507	\$0.00	
Newton	Village	Newtonia	231	\$0.00	
Newton	Village	Redings Mill	159	\$0.00	
Newton	Village	Ritchey	76	\$0.00	
Newton	Village	Saginaw	276	\$0.00	
Newton	City	Seneca	2,135	\$0.00	
Newton	Village	Shoal Creek Drive	346	\$0.00	
Newton	Village	Shoal Creek Estates	51	\$0.00	
Newton	Village	Silver Creek	608	\$0.00	
Newton	Village	Stark City	156	\$0.00	
Newton	Village	Stella	178	\$0.00	
Newton	Village	Wentworth	141	\$0.00	
<b>Nodaway</b>	<b>County</b>	<b>County-Wide</b>	<b>21,912</b>	<b>\$19,958.00</b>	<b>69.9</b>

County	Community	Community Name	Population	Average Income	Per Capita Income
	Type		2000	Per Capita	% of US 1999
Nodaway	Village	Arko	58	\$0.00	
Nodaway	City	Barnard	257	\$0.00	
Nodaway	City	Burlington Junction	632	\$0.00	
Nodaway	City	Clearmont	191	\$0.00	
Nodaway	Village	Clyde	74	\$0.00	
Nodaway	City	Conception Junction	202	\$0.00	
Nodaway	City	Elmo	166	\$0.00	
Nodaway	City	Graham	191	\$0.00	
Nodaway	Village	Guilford	87	\$0.00	
Nodaway	City	Hopkins	579	\$0.00	
Nodaway	City	Parnell	197	\$0.00	
Nodaway	Village	Pickering	154	\$0.00	
Nodaway	City	Quitman	46	\$0.00	
Nodaway	City	Ravenwood	448	\$0.00	
Nodaway	City	Skidmore	342	\$0.00	
<b>Oregon</b>	<b>County</b>	<b>County-Wide</b>	<b>10,344</b>	<b>\$14,930.00</b>	<b>52.3</b>
Oregon	City	Alton	668	\$0.00	
Oregon	City	Koshkonong	205	\$0.00	
Oregon	City	Thayer	2,201	\$0.00	
<b>Osage</b>	<b>County</b>	<b>County-Wide</b>	<b>13,062</b>	<b>\$23,143.00</b>	<b>81.1</b>
Osage	Village	Argyle	164	\$0.00	
Osage	City	Belle	1,344	\$0.00	
Osage	City	Chamois	456	\$0.00	
Osage	Village	Freeburg	423	\$0.00	
Osage	City	Linn	1,354	\$0.00	
Osage	City	Meta	249	\$0.00	
Osage	City	Westphalia	320	\$0.00	
<b>Ozark</b>	<b>County</b>	<b>County-Wide</b>	<b>9,542</b>	<b>\$14,563.00</b>	<b>51</b>
Ozark	Village	Bakersfield	285	\$0.00	
Ozark	City	Gainesville	632	\$0.00	
Ozark	Village	Sundown	38	\$0.00	
Ozark	Village	Theodosia	240	\$0.00	
<b>Pemiscot</b>	<b>County</b>	<b>County-Wide</b>	<b>20,047</b>	<b>\$17,388.00</b>	<b>60.9</b>
Pemiscot	City	Bragg City	189	\$0.00	
Pemiscot	City	Cooter	440	\$0.00	
Pemiscot	City	Hayti Heights	771	\$0.00	
Pemiscot	Village	Hayward	123	\$0.00	
Pemiscot	City	Holland	246	\$0.00	
Pemiscot	City	Homestown	181	\$0.00	
Pemiscot	Village	North Wardell	170	\$0.00	
Pemiscot	Village	Pascola	138	\$0.00	
Pemiscot	City	Steele	2,263	\$0.00	
Pemiscot	City	Wardell	278	\$0.00	
<b>Perry</b>	<b>County</b>	<b>County-Wide</b>	<b>18,132</b>	<b>\$21,923.00</b>	<b>76.8</b>



County	Community	Community Name	Population	Average Income	Per Capita Income
	Type		2000	Per Capita	% of US 1999
Perry	City	Altenburg	309	\$0.00	
Perry		Biehle	11	\$0.00	
Perry	City	Frohna	192	\$0.00	
Perry		Lithium	0	\$0.00	
Perry	Village	Longtown	76	\$0.00	
<b>Pettis</b>	<b>County</b>	<b>County-Wide</b>	<b>39,403</b>	<b>\$23,018.00</b>	<b>80.6</b>
Pettis	City	Green Ridge	445	\$0.00	
Pettis	City	Houstonia	275	\$0.00	
Pettis	Village	Hughesville	174	\$0.00	
Pettis	City	La Monte	1,064	\$0.00	
Pettis	City	Smithton	510	\$0.00	
Pettis	Village	Ionia	108	\$0.00	
<b>Phelps</b>	<b>County</b>	<b>County-Wide</b>	<b>39,825</b>	<b>\$21,041.00</b>	<b>73.7</b>
Phelps	City	Doolittle	644	\$0.00	
Phelps	City	Edgar Springs	190	\$0.00	
Phelps	City	Newburg	484	\$0.00	
<b>Pike</b>	<b>County</b>	<b>County-Wide</b>	<b>18,351</b>	<b>\$19,651.00</b>	<b>68.8</b>
Pike	Village	Annada	48	\$0.00	
Pike		Ashburn	51	\$0.00	
Pike	City	Clarksville	490	\$0.00	
Pike	City	Curryville	251	\$0.00	
Pike	Village	Eolia	435	\$0.00	
Pike	City	Frankford	351	\$0.00	
Pike	Village	Paynesville	91	\$0.00	
Pike	Village	Tarrants	30	\$0.00	
<b>Platte</b>	<b>County</b>	<b>County-Wide</b>	<b>73,781</b>	<b>\$32,753.00</b>	<b>114.7</b>
Platte	City	Camden Point	484	\$0.00	
Platte	City	Dearborn	529	\$0.00	
Platte	City	Edgerton	533	\$0.00	
Platte	Village	Farley	226	\$0.00	
Platte	Village	Ferrelview	593	\$0.00	
Platte	City	Houston Lake	284	\$0.00	
Platte	Village	Iatan	54	\$0.00	
Platte	City	Lake Waukomis	917	\$0.00	
Platte	City	Northmoor	399	\$0.00	
Platte	City	Platte Woods	474	\$0.00	
Platte	Village	Ridgely	64	\$0.00	
Platte	City	Riverside	2,979	\$0.00	
Platte	City	Tracy	213	\$0.00	
Platte	City	Weatherby Lake	1,873	\$0.00	
Platte	City	Weston	1,631	\$0.00	
<b>Polk</b>	<b>County</b>	<b>County-Wide</b>	<b>26,992</b>	<b>\$17,624.00</b>	<b>61.7</b>
Polk	Village	Aldrich	75	\$0.00	
Polk	City	Fair Play	418	\$0.00	

County	Community	Community Name	Population	Average Income	Per Capita Income
	Type		2000	Per Capita	% of US 1999
Polk	Village	Flemington	124	\$0.00	
Polk	Village	Halfway	176	\$0.00	
Polk	City	Humansville	946	\$0.00	
Polk	City	Morrisville	344	\$0.00	
Polk	City	Pleasant Hope	548	\$0.00	
<b>Pulaski</b>	<b>County</b>	<b>County-Wide</b>	<b>41,165</b>	<b>\$23,039.00</b>	<b>80.7</b>
Pulaski	City	Crocker	1,033	\$0.00	
Pulaski	City	Dixon	1,570	\$0.00	
Pulaski	City	Richland	1,805	\$0.00	
Pulaski	City	St. Robert	2,760	\$0.00	
<b>Putnam</b>	<b>County</b>	<b>County-Wide</b>	<b>5,223</b>	<b>\$16,976.00</b>	<b>59.5</b>
Putnam	Village	Livonia	114	\$0.00	
Putnam	Village	Lucerne	92	\$0.00	
Putnam	City	Powersville	86	\$0.00	
Putnam	City	Unionville	2,041	\$0.00	
Putnam		Worthington	89	\$0.00	
<b>Ralls</b>	<b>County</b>	<b>County-Wide</b>	<b>9,626</b>	<b>\$20,047.00</b>	<b>70.2</b>
Ralls	City	Center	644	\$0.00	
Ralls	City	New London	1,001	\$0.00	
Ralls	City	Perry	666	\$0.00	
Ralls/Monroe	City	Monroe City	2,588	\$0.00	
Ralls	Village	Rensselaer	145	\$0.00	
<b>Randolph</b>	<b>County</b>	<b>County-Wide</b>	<b>24,663</b>	<b>\$19,448.00</b>	<b>68.1</b>
Randolph	Village	Cairo	293	\$0.00	
Randolph	City	Clark	275	\$0.00	
Randolph	City	Clifton Hill	124	\$0.00	
Randolph	City	Higbee	623	\$0.00	
Randolph	City	Huntsville	1,553	\$0.00	
Randolph	Village	Jacksonville	163	\$0.00	
Randolph	Village	Renick	221	\$0.00	
<b>Ray</b>	<b>County</b>	<b>County-Wide</b>	<b>23,354</b>	<b>\$20,005.00</b>	<b>70.1</b>
Ray	City	Camden	209	\$0.00	
Ray	City	Crystal Lakes	383	\$0.00	
Ray	Village	Elmira	82	\$0.00	
Ray	City	Fleming	122	\$0.00	
Ray	City	Hardin	614	\$0.00	
Ray	City	Henrietta	457	\$0.00	
Ray		Homestead	181	\$0.00	
Ray	City	Orrick	889	\$0.00	
Ray	Village	Rayville	204	\$0.00	
Ray	City	Woods Heights	742	\$0.00	
Ray	City	Excelsior Estates	263	\$0.00	
Ray	City	Lawson	2,336	\$0.00	
<b>Reynolds</b>	<b>County</b>	<b>County-Wide</b>	<b>6,689</b>	<b>\$16,395.00</b>	<b>57.4</b>

County	Community	Community Name	Population	Average Income	Per Capita Income
	Type		2000	Per Capita	% of US 1999
Reynolds	City	Centerville	171	\$0.00	
Reynolds	City	Ellington	1,045	\$0.00	
Reynolds	City	Bunker	427	\$0.00	
<b>Ripley</b>	<b>County</b>	<b>County-Wide</b>	<b>13,509</b>	<b>\$14,199.00</b>	<b>49.7</b>
Ripley	City	Doniphan	1,932	\$0.00	
Ripley	City	Naylor	610	\$0.00	
<b>Saline</b>	<b>County</b>	<b>County-Wide</b>	<b>23,756</b>	<b>\$22,556.00</b>	<b>79</b>
Saline	Village	Arrow Rock	79	\$0.00	
Saline	City	Gilliam	229	\$0.00	
Saline	Village	Grand Pass	53	\$0.00	
Saline	City	Malta Bend	249	\$0.00	
Saline	City	Miami	160	\$0.00	
Saline	Village	Mount Leonard	123	\$0.00	
Saline	City	Nelson	212	\$0.00	
Saline	City	Slater	2,083	\$0.00	
Saline	City	Sweet Springs	1,628	\$0.00	
Saline	City	Blackburn	284	\$0.00	
Saline	City	Emma	243	\$0.00	
<b>Schuyler</b>	<b>County</b>	<b>County-Wide</b>	<b>4,170</b>	<b>\$14,773.00</b>	<b>51.8</b>
Schuyler	City	Downing	396	\$0.00	
Schuyler	Village	Glenwood	203	\$0.00	
Schuyler	City	Lancaster	737	\$0.00	
Schuyler	City	Queen City	638	\$0.00	
Schuyler	City	Greentop	427	\$0.00	
<b>Scotland</b>	<b>County</b>	<b>County-Wide</b>	<b>4,983</b>	<b>\$18,429.00</b>	<b>64.6</b>
Scotland	Village	Arbela	40	\$0.00	
Scotland	Village	Granger	44	\$0.00	
Scotland	City	Memphis	2,061	\$0.00	
Scotland	Village	Rutledge	103	\$0.00	
Scotland	City	South Gorin	143	\$0.00	
<b>Scott</b>	<b>County</b>	<b>County-Wide</b>	<b>40,422</b>	<b>\$20,813.00</b>	<b>72.9</b>
Scott	City	Benton	732	\$0.00	
Scott	Village	Blodgett	265	\$0.00	
Scott	City	Commerce	110	\$0.00	
Scott	Village	Diehlstadt	163	\$0.00	
Scott	Village	Haywood City	239	\$0.00	
Scott	Village	Kelso	527	\$0.00	
Scott		Lambert	49	\$0.00	
Scott/Mississippi	City	Miner	1,056	\$0.00	
Scott	City	Morley	792	\$0.00	
Scott	City	Oran	1,264	\$0.00	
Scott	Village	Vanduser	217	\$0.00	
<b>Shannon</b>	<b>County</b>	<b>County-Wide</b>	<b>8,324</b>	<b>\$14,898.00</b>	<b>52.2</b>
Shannon	City	Birch Tree	634	\$0.00	

County	Community	Community Name	Population	Average Income	Per Capita Income
	Type		2000	Per Capita	% of US 1999
Shannon	City	Eminence	548	\$0.00	
Shannon	City	Summersville	544	\$0.00	
Shannon	City	Winona	1,290	\$0.00	
<b>Shelby</b>	<b>County</b>	<b>County-Wide</b>	<b>6,799</b>	<b>\$19,397.00</b>	<b>67.9</b>
Shelby	Village	Bethel	121	\$0.00	
Shelby	City	Clarence	915	\$0.00	
Shelby	City	Hunnewell	227	\$0.00	
Shelby	Village	Leonard	66	\$0.00	
Shelby	City	Shelbina	1,943	\$0.00	
Shelby	City	Shelbyville	682	\$0.00	
<b>St. Charles</b>	<b>County</b>	<b>County-Wide</b>	<b>283,883</b>	<b>\$27,586.00</b>	<b>96.6</b>
St. Charles	Village	Augusta	218	\$0.00	
St. Charles	City	Cottleville	1,928	\$0.00	
St. Charles	City	Flint Hill	379	\$0.00	
St. Charles	City	Foristell	331	\$0.00	
St. Charles	Village	Josephville	270	\$0.00	
St. Charles	Village	New Melle	124	\$0.00	
St. Charles	City	Portage Des Sioux	351	\$0.00	
St. Charles	City	St. Paul	1,634	\$0.00	
St. Charles	Village	Weldon Spring Heights	79	\$0.00	
St. Charles		West Alton	573	\$0.00	
<b>St. Clair</b>	<b>County</b>	<b>County-Wide</b>	<b>9,652</b>	<b>\$16,615.00</b>	<b>58.2</b>
St. Clair	City	Appleton City	1,314	\$0.00	
St. Clair	Village	Collins	176	\$0.00	
St. Clair	Village	Gerster	35	\$0.00	
St. Clair	City	Lowry City	728	\$0.00	
St. Clair	City	Osceola	835	\$0.00	
St. Clair	Village	Roscoe	112	\$0.00	
St. Clair	Village	Vista	55	\$0.00	
<b>St. Francois</b>	<b>County</b>	<b>County-Wide</b>	<b>55,641</b>	<b>\$18,215.00</b>	<b>63.8</b>
St. Francois	City	Bismarck	1,470	\$0.00	
St. Francois	City	Iron Mountain Lake	693	\$0.00	
St. Francois	City	Leadington	206	\$0.00	
St. Francois	City	Leadwood	1,160	\$0.00	
<b>St. Louis</b>	<b>County</b>	<b>County-Wide</b>	<b>1,016,315</b>	<b>\$38,886.00</b>	<b>136.2</b>
St. Louis	City	Bella Villa	687	\$0.00	
St. Louis	Village	Bellerive	254	\$0.00	
St. Louis	Village	Bel-Nor	1,598	\$0.00	
St. Louis	City	Beverly Hills	603	\$0.00	
St. Louis	Village	Calverton Park	1,322	\$0.00	
St. Louis	Village	Champ	12	\$0.00	
St. Louis	City	Charlack	1,431	\$0.00	
St. Louis	City	Clarkson Valley	2,675	\$0.00	
St. Louis	City	Cool Valley	1,081	\$0.00	

County	Community	Community Name	Population	Average Income	Per Capita Income
	Type		2000	Per Capita	% of US 1999
St. Louis	City	Country Club Hills	1,381	\$0.00	
St. Louis	Village	Country Life Acres	81	\$0.00	
St. Louis	City	Crystal Lake Park	457	\$0.00	
St. Louis	City	Edmundson	840	\$0.00	
St. Louis	City	Flordell Hills	931	\$0.00	
St. Louis	Village	Glen Echo Park	166	\$0.00	
St. Louis	Village	Grantwood Village	883	\$0.00	
St. Louis	City	Greendale	722	\$0.00	
St. Louis	City	Green Park	2,666	\$0.00	
St. Louis	Village	Hanley Hills	2,124	\$0.00	
St. Louis	Village	Hillsdale	1,477	\$0.00	
St. Louis	City	Huntleigh	323	\$0.00	
St. Louis	City	Kinloch	449	\$0.00	
St. Louis	City	Lakeshire	1,375	\$0.00	
St. Louis	Village	Mackenzie	137	\$0.00	
St. Louis	Village	Marlborough	2,235	\$0.00	
St. Louis	City	Moline Acres	2,662	\$0.00	
St. Louis	Village	Norwood Court	1,061	\$0.00	
St. Louis	City	Oakland	1,540	\$0.00	
St. Louis	City	Pasadena Hills	1,147	\$0.00	
St. Louis	Village	Pasadena Park	489	\$0.00	
St. Louis	City	St. George	1,288	\$0.00	
<b>St. Louis</b>	<b>City</b>	<b>St. Louis</b>	<b>348,189</b>	<b>\$26,963.00</b>	
St. Louis	Village	Sycamore Hills	722	\$0.00	
St. Louis	Village	Twin Oaks	362	\$0.00	
St. Louis	Village	Uplands Park	460	\$0.00	
St. Louis	City	Velda City	1,616	\$0.00	
St. Louis	Village	Velda Village Hills	1,090	\$0.00	
St. Louis	City	Vinita Park	1,924	\$0.00	
St. Louis	Village	Vinita Terrace	292	\$0.00	
St. Louis	City	Warson Woods	1,983	\$0.00	
St. Louis	City	Wellston	2,460	\$0.00	
St. Louis	Village	Westwood	284	\$0.00	
St. Louis	Village	Wilbur Park	475	\$0.00	
St. Louis	City	Winchester	1,651	\$0.00	
<b>Ste. Genevieve</b>	<b>County</b>	<b>County-Wide</b>	<b>17,842</b>	<b>\$21,152.00</b>	<b>74.1</b>
Ste. Genevieve	City	Bloomsdale	419	\$0.00	
Ste. Genevieve	City	St. Mary	377	\$0.00	
<b>Stoddard</b>	<b>County</b>	<b>County-Wide</b>	<b>29,705</b>	<b>\$19,552.00</b>	<b>68.5</b>
Stoddard	City	Advance	1,244	\$0.00	
Stoddard		Baker	5	\$0.00	
Stoddard	City	Bell City	461	\$0.00	
Stoddard	City	Bernie	1,777	\$0.00	
Stoddard	City	Bloomfield	1,952	\$0.00	

County	Community	Community Name	Population	Average Income	Per Capita Income
	Type		2000	Per Capita	% of US 1999
Stoddard	City	Dudley	289	\$0.00	
Stoddard	City	Essex	524	\$0.00	
Stoddard	City	Puxico	1,145	\$0.00	
<b>Stone</b>	<b>County</b>	<b>County-Wide</b>	<b>28,658</b>	<b>\$21,660.00</b>	<b>75.9</b>
Stone	Village	Blue Eye	129	\$0.00	
Stone	City	Branson West	408	\$0.00	
Stone	Village	Coney Island	94	\$0.00	
Stone	City	Crane	1,390	\$0.00	
Stone	City	Galena	451	\$0.00	
Stone	City	Hurley	157	\$0.00	
Stone	Village	Indian Point	588	\$0.00	
Stone	City	Kimberling City	2,253	\$0.00	
Stone	Village	McCord Bend	292	\$0.00	
Stone	City	Reeds Spring	465	\$0.00	
<b>Sullivan</b>	<b>County</b>	<b>County-Wide</b>	<b>7,219</b>	<b>\$19,856.00</b>	<b>69.6</b>
Sullivan	City	Greencastle	308	\$0.00	
Sullivan	City	Green City	688	\$0.00	
Sullivan	City	Harris	105	\$0.00	
Sullivan	Village	Humphreys	164	\$0.00	
Sullivan	City	Milan	1,958	\$0.00	
Sullivan	City	Newtown	209	\$0.00	
Sullivan	Village	Osgood	51	\$0.00	
Sullivan		Pollock	131	\$0.00	
<b>Taney</b>	<b>County</b>	<b>County-Wide</b>	<b>39,703</b>	<b>\$22,035.00</b>	<b>77.2</b>
Taney	Village	Bull Creek	225	\$0.00	
Taney	City	Forsyth	1,686	\$0.00	
Taney	Village	Merriam Woods	1,142	\$0.00	
Taney	City	Rockaway Beach	577	\$0.00	
Taney	Village	Table Rock	229	\$0.00	
Taney	Village	Taneyville	359	\$0.00	
<b>Texas</b>	<b>County</b>	<b>County-Wide</b>	<b>23,003</b>	<b>\$15,166.00</b>	<b>53.1</b>
Texas	City	Cabool	2,168	\$0.00	
Texas	City	Houston	1,992	\$0.00	
Texas	City	Licking	1,471	\$0.00	
Texas	Village	Raymondville	442	\$0.00	
Texas	City	Summersville	544	\$0.00	
<b>Vernon</b>	<b>County</b>	<b>County-Wide</b>	<b>20,454</b>	<b>\$19,420.00</b>	<b>68</b>
Vernon	City	Bronaugh	245	\$0.00	
Vernon	Village	Deerfield	75	\$0.00	
Vernon	Village	Harwood	90	\$0.00	
Vernon	Village	Metz	67	\$0.00	
Vernon	Village	Milo	84	\$0.00	
Vernon	Village	Moundville	103	\$0.00	
Vernon	Village	Richards	95	\$0.00	

County	Community	Community Name	Population	Average Income	Per Capita Income
	Type		2000	Per Capita	% of US 1999
Vernon	City	Schell City	286	\$0.00	
Vernon	City	Sheldon	529	\$0.00	
Vernon	Village	Stotesbury	43	\$0.00	
Vernon	City	Walker	275	\$0.00	
<b>Warren</b>	<b>County</b>	<b>County-Wide</b>	<b>24,525</b>	<b>\$21,060.00</b>	<b>73.8</b>
Warren	Village	Innsbrook	469	\$0.00	
Warren	City	Marthasville	837	\$0.00	
Warren	City	Truesdale	397	\$0.00	
Warren	City	Wright City	1,532	\$0.00	
Warren	City	Foristell	331	\$0.00	
<b>Washington</b>	<b>County</b>	<b>County-Wide</b>	<b>23,344</b>	<b>\$15,883.00</b>	<b>55.6</b>
Washington	Village	Caledonia	158	\$0.00	
Washington	City	Irondale	437	\$0.00	
Washington	Village	Mineral Point	363	\$0.00	
Washington	City	Potosi	2,662	\$0.00	
<b>Wayne</b>	<b>County</b>	<b>County-Wide</b>	<b>13,259</b>	<b>\$15,137.00</b>	<b>53</b>
Wayne	City	Greenville	451	\$0.00	
Wayne	Village	Mill Spring	219	\$0.00	
Wayne	City	Piedmont	1,992	\$0.00	
Wayne	City	Williamsville	379	\$0.00	
<b>Webster</b>	<b>County</b>	<b>County-Wide</b>	<b>31,045</b>	<b>\$16,822.00</b>	<b>58.9</b>
Webster	Village	Diggins	298	\$0.00	
Webster	City	Fordland	684	\$0.00	
Webster	City	Niangua	445	\$0.00	
Webster	City	Rogersville	1,508	\$0.00	
Webster	City	Seymour	1,834	\$0.00	
<b>Worth</b>	<b>County</b>	<b>County-Wide</b>	<b>2,382</b>	<b>\$16,911.00</b>	<b>59.2</b>
Worth	City	Allendale	54	\$0.00	
Worth	Village	Denver	40	\$0.00	
Worth	City	Grant City	926	\$0.00	
Worth	City	Sheridan	185	\$0.00	
Worth	Village	Worth	94	\$0.00	
<b>Wright</b>	<b>County</b>	<b>County-Wide</b>	<b>17,955</b>	<b>\$14,410.00</b>	<b>50.5</b>
Wright	City	Hartville	607	\$0.00	
Wright	City	Mansfield	1,349	\$0.00	
Wright	City	Norwood	552	\$0.00	

## Appendix 4

**See Community Status Book for Missouri**